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Morgan Lewis
C O U N S E L O R S A T L A W

Timothy P. Matthews
202-739-5527
tmatthews@morganlewis.com

January 14, 2003

Director, Office of Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Reply to Notice of Violation

Gentlemen:

On December 13, 2002, Schlumberger EMR provided its response to NRC's Notice of Violation (NOV) EA-02-0209, dated November 13, 2002. The Company requested that the enclosure be withheld from public disclosure under 10 CFR 2.790(a)(6) because it contains personnel information, the disclosure of which would involve a clearly unwarranted invasion of personal privacy. This letter transmits a redacted version of that enclosure and its attachments, suitable for public disclosure. If you have any questions regarding these materials, please contact me.

Sincerely,



Timothy P. Matthews

Enclosure

cc: Herbert J. Miller, NRC RI Regional Administrator
 Daniel J. Holody, NRC RI

REDACTED
VERSION

Schlumberger

EMR Photoelectric
Division of Schlumberger Technology Corporation

20 Wallace Road
Princeton Junction, NJ 08550
Phone: (609) 799-1000

10 CFR 2.201
10 CFR 2.790

December 13, 2002

Director, Office of Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Reply to Notice of Violation; EA-02-0209

Gentlemen:

The enclosure to this letter provides Schlumberger EMR's ("the Company's") response to Notice of Violation (NOV) EA-02-0209, dated November 13, 2002, following the format specified in the NOV and NRC Rules of Practice at 10 CFR 2.201. This NOV response contains confidential personnel file information, the disclosure of which would involve a clearly unwarranted invasion of personal privacy. Accordingly, Schlumberger EMR requests that the enclosed NOV response be withheld from public disclosure under 10 CFR 2.790(a)(6).

The basis for the Company's conclusions are more fully set out in the enclosed NOV response. In summary, the Company disagrees with the NRC's conclusion that the undisputed deliberate misconduct by a former radiation technician resulted in inaccurate personnel exposure records. A timely investigation upon receipt of the preliminary sample results revealed that the unusually high tritium levels were likely the result of sample contamination and not an actual tritium uptake. The results of that investigation were recorded in the minutes of the Radiation Safety Committee June 2000 meeting and referenced with the affected individual's radiation exposure records. Because prompt attentive action by the licensee prevented inaccurate or incomplete radiation dose records no enforcement action is appropriate.

Additionally, although the Company agrees with the NRC's conclusion that the former employee deliberately submitted a false bioassay and withheld that information from the Company, Schlumberger EMR disagrees with the NRC's apparent conclusion that a second, current, employee acted either deliberately to falsify, or with careless disregard for the completeness or accuracy of, any

Ref: 000730046205/Christine Kr Date: 13DEC02 SHIPPING \$5.57
Dept: Wgt: 0.5 LBS SPECIAL \$0.22
HANDLING \$0.00

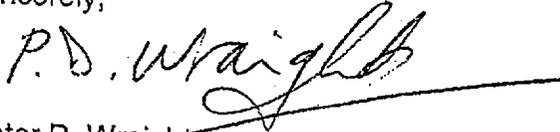
TOTAL \$5.79

SERVICE: PRIORITY OVERNIGHT
TRACK: 6194 2979 2358

required record. Regardless, as noted above, the erroneous test results were detected by the Company promptly and documented with the appropriate exposure records.

If you have any questions regarding this NOV response, please contact the RSO, Christine Krieman at (609) 897-8513.

Sincerely,

A handwritten signature in black ink that reads "P.D. Wraight". The signature is written in a cursive style and is positioned above a solid horizontal line.

Peter D. Wraight

Enclosure

c: Hubert J. Miller, NRC RI Regional Administrator
Mark Mullen, NRC RI OI



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Response to NOV EA-02-209

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Summary of the Violation:

10 CFR 20.2106(a) requires that licensees maintain records of doses received by all individuals for whom monitoring was required pursuant to 10 CFR 20.1502.

10 CFR 20.1502 requires, in part, that licensees shall monitor exposures to radiation and radioactive materials at levels sufficient to demonstrate compliance with occupational dose limits.

10 CFR 30.9(a) requires, in part, that information required by the Commission's regulations to be maintained by the licensee, shall be complete and accurate in all material respects

Contrary to the above, on May 16, 2000, two technicians willfully caused the creation of a record containing information required to monitor exposures to radiation and radioactive materials that was not accurate in all material respects. Specifically, a technician submitted a water sample contaminated with tritium for bioassay analysis indicating that the sample was his own urine sample, and another technician allowed the false sample to be submitted as the employee's urine sample to the licensee's contractor laboratory for bioassay analysis. The bioassay record created by this false sample was not accurate because it did not represent the correct urine bioassay results for the technician.

This is a Severity Level IV violation (Supplements VI & VII).

(1) Admit or Deny the Violation

Schlumberger EMR admits that deliberate misconduct on the part of [REDACTED], a Radiation Technician and former employee who submitted a false bioassay sample, created an inaccurate bioassay test result. Schlumberger EMR denies that its dose records for [REDACTED], required pursuant to 20 CFR §§ 20.1502 and 20.2106, were inaccurate. As discussed more fully below, Schlumberger EMR's Radiation Safety Officer (RSO) recognized that, for whatever the reason, the bioassay results for [REDACTED] did not reflect accurately his actual tritium uptake and resultant radiation exposure. Although the Company conservatively limited [REDACTED] future radiation exposure, Company records accurately reflect both the test results and the results of the RSO's investigation.

Schlumberger EMR denies the NRC's assessment that the conduct of [REDACTED], a Radiation Technician and current employee, involved either intentional misconduct or careless disregard for the completeness and accuracy

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of required records. Additionally, as noted above, without regard for the intent of either employee, prompt comprehensive actions by the RSO prevented the inaccurate test results from leading to an inaccurate exposure record.

Finally, although not described in the NOV, Schlumberger EMR's investigation showed that deliberate misconduct by a third individual, [REDACTED], a Radiation Technician and former employee, also contributed to this event.

(2) **Reasons for the Company's Position**

(a) [REDACTED]

[REDACTED] admitted deliberate falsification of bioassay samples. Was there more than ONE false sample submitted? Regardless of his subsequently-articulated reasons for submitting false samples in the first place, [REDACTED] deliberately lied to the RSO in the course of his June 2000 investigation as to the possible sources of a potential tritium uptake. Only when later confronted in early 2002 with a witness's statement about the false bioassay, did [REDACTED] acknowledge his own involvement. In that confession, [REDACTED] also indicated that [REDACTED] had prior knowledge of his plan to submit a false sample and that he conspired with [REDACTED] to hide the truth from the RSO. A written summary of the initial interview and videotape of the subsequent deposition (taken after his termination) have been provided previously.

The record keeping requirement cited, 10 CFR 20.106(a), pertains to personnel radiation exposure records. Although [REDACTED] acted deliberately and knowingly to provide a false urine sample for bioassay analysis, prompt actions by the RSO prevented the false sample from causing an incomplete or inaccurate dose record. Specifically, the RSO had the suspect bioassay sample reanalyzed by the same laboratory and by an independent laboratory. Additionally, he re-tested [REDACTED] and assessed the rate of tritium decay. Subsequent bioassay samples results showed low tritium levels that were inconsistent with the relatively high tritium levels indicated by the initial sample. The RSO's investigation concluded that the unusually high bioassay results were possibly caused by sample contamination or a malfunction of the laboratory equipment. The evidence available to the RSO at that time did not reveal [REDACTED] deliberate sample contamination.

The RSO's investigation results were reported in the minutes of the Radiation Safety Committee June 2000 meeting, along with the bioassay test results for [REDACTED]. [REDACTED] Although Schlumberger EMR conservatively calculated [REDACTED]'s (still very low) personnel exposure based upon the test results, the records clearly reflect the unreliable nature of the sample result. (Copy enclosed.)

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The NRC's Statements of Considerations accompanying publication of 10 CFR 30.9, address the application of the NRC Enforcement Policy to this situation. "Generally, if the matter was promptly identified and corrected by the licensee prior to reliance by the NRC, or the NRC raising a question about the information, no enforcement will be taken for the initial inaccurate or incomplete information." 52 Fed. Reg. 49362, December 31, 1997. Here, the RSO noted the unusual test result, investigated it, documented his conclusions, and conservatively restricted the individual's future exposures. In essence, the Company thwarted [REDACTED] attempt to falsify his dose assessment. The Statements of Consideration make clear that, in this situation, the licensee should not be penalized.

With respect to the data on the manifest transmitting the sample to the laboratory for analysis, 10 CFR 30.9 is not intended to reach every error in every document written at the licensee's facility. By its terms, it addresses only material information required to be submitted to the NRC or maintained by the licensee. Again, the Statement of Considerations addresses this point. "The failure to correct inaccurate or incomplete information which the licensee does not identify as significant normally will not constitute a separate violation." What is significant in this case is the dose assessment for [REDACTED] and not the shipping manifest which accompanied the sample to the laboratory. Bioassay samples are not subject to the same rigorous visual observation and chain-of-custody controls associated with urine samples for fitness-for-duty programs.

(b) [REDACTED]
[REDACTED] may have had reason to suspect that the bioassay sample submitted by [REDACTED] was not his own urine, but rather a sample of potentially contaminated water. [REDACTED] previously had tipped-off [REDACTED] to his idea of submitting water as a urine sample, and showed him a sample bottle of water from the roof. [REDACTED] testified, however, that he did not see [REDACTED] place any sample in the bag, did not exercise control of the bioassay samples prior to shipment, and did not further discuss the content of the sample with [REDACTED] prior to shipment. Rather, [REDACTED] simply recorded on the manifest the information provided by [REDACTED] on the sample bag for submittal to the testing laboratory.

An understanding of the sample process is important to understanding [REDACTED] actions. Each sample is packaged solely by the person submitting the sample. The worker provides the sample directly into a translucent bottle, caps it, and places the bottle into a zip-loc sandwich bag. The same worker then writes his name, date, reason for the sample, and "EMR" on the outside of the bag and staples it shut. [REDACTED] later prepares samples for shipment by placing the paper bags into a box and transferring the data on the bags onto a manifest.

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In this case, although sometime prior to shipment of the samples to the laboratory, ██████████ showed ██████████ a sample bottle of water, ██████████ had no way of knowing, with any degree of certainty, whether any of the multiple samples submitted by ██████████ were not real. Further, ██████████ previously had told ██████████ that the sample did not look like urine, thus making it more likely ██████████ would not actually carry out his original idea. The conclusion that ██████████ was a knowing accomplice in ██████████ wrongdoing is not supported by the facts.

Although the Company expected that ██████████ would not submit a suspicious sample without first informing management, this conduct does not rise to the level of deliberate misconduct as that term is used by the NRC. Clearly, since he did not know with any degree of certainty what the sample bottle contained before the results were reported, he did not act "intentionally." Suspicion alone does not rise to the level of knowledge required for "careless disregard" of completeness and accuracy requirements.

When the laboratory results came back, ██████████ remembered his prior discussion with ██████████, suspected sample contamination, and reported timely his suspicion to his supervisor, ██████████. Fearing retribution from ██████████, ██████████ expected that ██████████ would report the matter to senior management and the RSO, but specifically requested that his name not be used. ██████████ who worked closely with all three of these technicians, understood ██████████ concern and honored that good-faith request by limiting his disclosures about the sample contamination to senior managers and the RSO to protect ██████████ identity. For the same reason, ██████████ did not report his suspicion directly to the RSO when this issue was discussed before the Radiation Safety Committee (including Messrs ██████████) in June 2000. Significantly, ██████████ recognized that the RSO – although apparently unaware of the deliberate wrongdoing – was not fooled. The RSO recognized that the high readings resulted from sample contamination not ██████████ actual tritium uptake.

Overall, ██████████ certainly could have done a better job of informing Schlumberger EMR management of his concern upon receipt of the unusually high results or even before the sample was sent. However, the evidence does not support the NRC's conclusion that ██████████ "knowingly allowed a false bioassay sample to be shipped out to a contractor for analysis," and "willfully caused the creation of a record that was required to monitor exposures to radiation and radioactive material that was not accurate in material respects." As noted above, the RSO's timely and thorough investigation prevented the falsified urine sample from resulting in inaccurate or incomplete radiation exposure records.

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In January 2002, after the conclusion of his OI interview, [REDACTED] requested confidential-allegor status and voluntarily reported events related to the falsified bioassay to NRC OI. [REDACTED] subsequently reported the same information to EMR General Manager Peter Wright. The Company investigated [REDACTED] statement and, after hearing their statements, [REDACTED] for gross misconduct associated with this event. The Company also issued disciplinary letters to [REDACTED] for their failures to more fully report the extent of their knowledge to the RSO and Company management. A summary of the Company's investigation, reasons for the termination, and copies of the disciplinary letters were previously provided.

(c) [REDACTED]
Finally, although not noted in the NOV, the preponderance of the evidence shows that [REDACTED] deliberate misconduct contributed to this event. [REDACTED] had prior knowledge of [REDACTED] to submit a false bioassay, failed to inform the Company of the false sample once submitted, intimidated [REDACTED] when he suggested reporting [REDACTED] the actual source of the sample, and lied to Company officials when questioned about his knowledge of the false bioassay. The bases for the Company's investigators were described in a "Summary of the February 11, 2002 Termination [REDACTED]" (previously provided).

(3) Corrective Actions Taken

With respect to the high bioassay results, on the day Schlumberger received the preliminary results, the RSO immediately required [REDACTED] to submit another sample and sent it for analysis. Contemporaneously, he evaluated the NRC reporting requirements and determined that, even if accurate, no reports were required. Additionally, he asked the laboratory to retest the initial sample. During the course of his investigation, the RSO also had the sample split and sent to another laboratory for independent confirmation.

The RSO's investigation showed that the original sample, however it became contaminated, could not have accurately reflected [REDACTED] tritium uptake or radiation exposure. Conservatively, however, the RSO limited [REDACTED] radiation work activities. The results of the RSO's investigation were presented to the Radiation Safety Committee on June 29, 2000, along with the monthly bioassay results. [REDACTED] sample results and the RSO's conclusions were documented in an accompanying memorandum from the RSO to the Radiation Safety Committee dated June 28, 2000 and discussed at the meeting the following day.

The RSO's investigation in 2000 did not uncover the deliberate wrongdoing on the part of [REDACTED]. Although the RSO recognized the possibility of



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deliberate bioassay sample contamination, without a more direct witness statement the evidence was indeterminate. Because the cause of the sample contamination was indeterminate, the Company's recommended corrective actions focused on preventing sample contamination in the future by adopting more rigorous sample controls, contamination control in tritium areas, and reducing opportunities for tritium uptakes. The Company took measures to improve further the already-low radiation exposures received by workers at the Princeton facility and to control more rigorously the bioassay sample process. The agenda of the June 2000 Radiation Safety Committee meeting shows that bioassay testing procedures were discussed. Recommendations for corrective actions were identified in the June 28, 2000 investigation report. Corrective actions involving tighter control over when bioassay samples would be required and how the bioassay sample should be prepared have been implemented.

Completion of corrective actions associated with the deliberate misconduct of [redacted] were completed upon their terminations from the Company on February 11, 2002. Corrective actions associated with this event for personnel errors of other employees that did not involve intentional wrongdoing were completed on May 15, 2002.

(4) Corrective Actions Planned

All corrective actions associated with this event have been completed.

(5) Date By Which Full Compliance Will Be Achieved

Any potential non-compliance associated with 10 CFR Part 20 record-keeping requirements was addressed at the time the Company received the results of the false bioassay. Specifically, the RSO reported the results of his investigation in the Radiation Safety Committee meeting minutes dated June 29, 2000 and provided appropriate annotations to [redacted] exposure record.

Radiation Safety Meeting - Review of Harold Pfutner's Audit Report

Thursday, June 29, 2000
9:00

Print Name	Signature
David Wabinchak	<i>[Signature]</i>
Carl Johnson	<i>[Signature]</i>
Wolfgang Ziegler	<i>[Signature]</i>
Joel Lee Groves	<i>[Signature]</i>
LUKE PERKINS	<i>[Signature]</i>
Nick Proers	<i>[Signature]</i>
STEFAN VAJDA	<i>[Signature]</i>
Cory Labanda	<i>[Signature]</i>
Steve Meddaugh	<i>[Signature]</i>
HARISH BHOLA	<i>[Signature]</i>
John Simonetti	<i>[Signature]</i>
Mike O'Brien	<i>[Signature]</i>
Kevin S. Lewis	<i>[Signature]</i>
Low Cannelli	<i>[Signature]</i>
Harold Pfutner	<i>[Signature]</i>

[Signature]
6/29/00

Radiation Safety Meeting 6/29/00 at 09:00

Introduction (Mike O'Brien):

- Meeting was brought to order.
- Attendance was taken.
- Announcements of monthly meetings until further notice.
- Announcement of new Radiation Safety Committee Chairman; Mike O'Brien

Task Force Summary (Harold Pfitzner- Task Force Leader):

- Summary of Generator Task Force purpose, goals, etc.
- Reviewed, in summary, the Audit Report performed in the past few weeks. Below is a summary of discussion points;
 - Storage of Radiation Waste/Contaminated Equipment
 - Need for monthly meeting, address minor issues more quickly
 - Handling of contaminated materials
 - Operation review of process
 - Proposed that the Radiation Safety Officer & Department Manager attend the PPL course
 - Minitron Database
 - Operation of Radiation Safety Committee

Bioassays (Joel Groves - Radiation Safety Officer):

- Passed out hand outs on Bioassay Results
- Discussed Bioassay Handouts
- Discussed guidelines in discussing information covered in the meeting outside of the Radiation safety Committee
- Bioassay Sample result turn-around
- Reviewed Radiation Manual Section 1.11 with Committee - EMR # 100224

Acknowledgement of Minutes and Action items by Management;

General Manager P. D. Wright

Radiation Safety Committee Chairman [Signature]

Radiation Safety Officer Joel Groves

Generator Task Force Leader Harold Pfitzner

Name	2000 BIOASSAY RESULTS												Activity Days (nCi-d/L)	Average Activity (nCi/L)	Yearly Dose (mrem)
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)	(nCi/L)			
	4.54	4.54	4.54	4.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	545	1.51	0.27
	6.34	6.34	6.34	6.34	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	9490	26.36	4.74
	3.30	1.57	1.57	1.57	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	1992	5.53	1.00
	0.31	241.41	241.41	241.41	241.41	241.41	241.41	241.41	241.41	241.41	241.41	241.41	79675	221.32	39.84
	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	346	0.96	0.17
	2.73	7.79	7.79	4.97	*	50.00	50.00	50.00	50.00	50.00	50.00	50.00	317288	881.36	158.64
	17.85	65.72	65.72	65.72	26.98	26.98	26.98	26.98	26.98	26.98	26.98	26.98	12926	35.90	6.46
	8.68	8.68	8.68	8.68	8.68	8.68	8.68	8.68	8.68	8.68	8.68	8.68	3125	8.68	1.56
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
	0.00	0.00	0.00	0.00	6.73	6.73	6.73	6.73	6.73	6.73	6.73	6.73	1615	4.49	0.81
	0.28	0.00	0.00	4.50	36.90	36.90	36.90	36.90	36.90	36.90	36.90	36.90	8999	25.00	4.50
	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	194	0.54	0.10
	0.00	0.00	0.00	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	972	2.70	0.49
					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
* Tritium radiation exposure for May calculated on a separate sheet.												Activity Days (nCi-d/L)	306090		
1 nCi/L = 37 Bq/L				1 Sv = 100 rem											
Yearly Dose (mrem) = 0.0005 * Activity Days (nCi-d/L) NUREG-0938 p10 eq7															
Note. Constant 28,000 nCi/L gives 5 rems/year; 2,800 nCi/L gives 500 mrem/year															
One time exposure with initial level of 35,000 nCi/L gives 250 mrem/year															
100 mrem = upper limit for NRC Yearly Dose to public															
10 mrem = upper limit target for EMR Yearly Dose to public															
5000 mrem = upper limit for NRC Yearly Dose to Radiation Workers															
500 mrem = upper limit target for EMR Yearly Dose to Radiation Workers															
Value in January column is either last bioassay in previous year or bioassay taken in January.															



Presented at
 Radiation Safety Meeting
 June 30, 2000
[Signature]

EMR Photoelectric

Schlumberger

20 Wallace Road
Princeton Junction, NJ 08550
Phone: (609) 799-1000

MEMO

TO: Radiation Safety Committee

DATE: June 28, 2000

FROM: Joel Groves, RSO *JG*

FILE: RSO: 00-09

SUBJECT: [REDACTED] Tritium Bioassays

During the month of May, [REDACTED] and [REDACTED] did valve work on the Processing Stations in the Minitron Processing Building. Tritium bioassays were taken after each time the station was opened to air. A log of the activities, stack tritium emissions and bioassay readings are listed below:

Date	Activities by [REDACTED] (# Refers to Station number)	Stack Emission (mCi)	[REDACTED] Bioassay (nCi/L)
4/27	Replaced gasket on #2 compression port		
5/2	Transferred compression port from #1 to #3		
5/2	Bioassay		4
5/4	Bioassay		16
5/13	Replaced #3 compression port & valve	1.6	
5/14	Replaced tritium vial on #1	23.2	
5/14	Replaced #1 capacitance manometer heads	109.	
5/15	Bioassay sample given		1,787 1,825
5/15	Replaced lower manifold valve on #2	25.5	
5/16	Bioassay sample given		36,060 33,265
5/17	Replaced two heater elements on #3		
5/18	Replaced damaged thermocouples on #3		

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5/22	Bioassay sample given		27,806 29,206
5/30	Bioassay sample given		74 69
6/6	Bioassay sample given		179
6/9	Bioassay sample given		50

██████████ tritium bioassays on 5/15 to 5/22 are unusually high for an EMR Tritium Processor. It appears that ██████████ major tritium uptake occurred during the replacement of the lower manifold valve on Station #2. No additional tritium uptake is expected from the activities on 5/17 and 5/18.

Estimate of ██████████ Radiation Dose:

The radiation dose from a one time exposure of 36,060 nanoCuries/Liter is estimated to be approximately 260 mrem assuming a 10 day body half-time. NUREG-0938 "Information for Establishing Bioassay Measurements and Evaluations of Tritium Exposure", page 9, equation 6, states that a single-uptake of tritium giving a bioassay of 35,000 nanoCuries/Liter results in a radiation dose of 250 mrem assuming a 10 day body half-time for tritium.

Attachment 1 gives the radiation dose for ██████████ calculated for the period from 5/2/2000 to 6/9/2000. The radiation dose calculated using the formulas from NUREG-0938 gives a dose of 153 mrem for the tritium bioassay results listed in the Table above. Where the bioassay samples were analyzed twice, the highest tritium concentration reading was used to calculate the radiation dose.

The maximum radiation dose to a Radiation Worker permitted by the NRC is 5,000 mrem and EMR's upper limit on radiation dose that an employee may receive is one tenth of that or 500 mrem. It is expected that ██████████ radiation dose will be well below EMR's upper limit of 500 mrem.

Actions Taken

May 30, 2000: Immediately upon receipt of a Fax copy of the report from Microtec Services (Attachment 2) showing the unusually high tritium bioassay results for ██████████ I called ██████████ and ██████████ to my office and showed the tritium bioassay results from Microtec Service to both ██████████. I informed ██████████ that a one time tritium dose giving a bioassay of 36,000,000 pCi/L (36,000 nCi/L) gives a radiation dose of approximately 250 mrem based on the formulas taken from NUREG-0938 "Information for Establishing Bioassay Measurements and Evaluations of Tritium Exposure". I discussed ██████████ radiation exposure in terms of the NRC limit of 5,000 mrem, and EMR's limit of 500 mrem.

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I informed [REDACTED] of the following:

- (1) I intended to keep [REDACTED] radiation exposure below EMR's limit of 500 mrem.
- (2) [REDACTED] cannot process any additional Minitrons until his tritium bioassay level drops below 500,000 pCi/L (500 nCi/L).
- (3) [REDACTED] cannot do any additional work on the Minitron processing stations this year that involves opening either the upper or lower manifolds to the air.

[REDACTED] requested that he be allowed to complete the Minitrons that were then mounted on the processing station. No movement of tritium was required. I agreed.

I asked [REDACTED] to give another bioassay sample (5/30/2000 sample in above table) which I shipped overnight to Microtec Services.

June 2, 2000: The results on the 5/30/2000 sample were received from Microtec Services (Attachment 3) and showed a tritium bioassay for [REDACTED] of 69,458 pCi/L (69.4 nCi/L) which is in the normal range for a tritium technician or tritium engineer at EMR.

I called Microtec Service and spoke with Quintin Stokley and discussed possible errors in their measurements since [REDACTED]'s tritium bioassay had dropped very quickly into the normal region. Quintin mentioned that chemical luminescence could cause an error in the tritium bioassay but that his instrument was designed to tag samples that had any significant chemical luminescence and that none of our samples had been tagged by his instrument. Quintin suggested that any signals from chemical luminescence could be eliminated by loading new samples from the bioassay bottles into the liquid scintillation counting instrument and letting them sit in the dark over the weekend.

I asked Quintin to rerun the [REDACTED] 5/15, 5/16, 5/22, and 5/30 bioassay samples and the [REDACTED] 5/30 bioassay sample with a weekend long rest in the dark.

June 5, 2000: I asked [REDACTED] to do a wipe test survey of the surfaces in the Minitron Processing Building to check for tritium contamination in the work areas. He wiped 27 areas and sent the wipes to Monitoring Services for analysis. (Attachment 4)

June 6, 2000: The results were received from Microtec Service for the samples left in the dark over the weekend that were requested in my telephone call on June 2, 2000. The results are shown in Attachment 5 and listed in the above Table. The samples run after sitting in the dark for a weekend are in agreement with the first set of results.

[REDACTED] provided another bioassay sample which was sent to Microtec Services for analysis.

June 7, 2000: The wipe test results of the samples taken in the Minitron Processing building were received from Monitoring Services (Attachment 6). The only areas showing surface contamination above the 35 Bq/100 cm² limit were inside the processing hoods or on the dissection hood. The highest tritium content wipe test over 100 cm²

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picked up 0.03 microCuries of tritium; whereas, a tritium bioassay sample of 100 ml with a tritium concentration of 36,060 nCi/L contains 3.6 microCuries.

June 8, 2000: The results were received from Microtec Services for bioassay samples provided on June 6, 2000. The results are shown in Attachment 7 and listed in the above Table.

June 9, 2000: [REDACTED] provided another bioassay sample which was sent to Microtec Services for analysis.

June 13, 2000: The results were received from Microtec Services for bioassay samples provided on June 9, 2000. The results are shown in Attachment 8 and listed in the above Table.

Three bioassay samples in a row are below the 500 nCi/L limit set for [REDACTED] to return to processing Minitrons.

I authorized [REDACTED] to return to processing Minitrons.

Conclusions

(1) [REDACTED] tritium bioassays following the replacement of the valves on the Minitron processing station are unusually high. Typically, tritium bioassays following open station work are in the 100's of nCi/L rather than the 10,000's nCi/L found in [REDACTED] bioassays.

A bioassay of 36,000 nCi/L corresponds to a total intake of about 1.5 milliCuries of tritium. During the valve work on the vacuum manifolds, a total of 160 milliCuries was released up the stack.

(2) [REDACTED] tritium bioassays returned to the normal levels much faster than expected.

For example, [REDACTED] tritium bioassay on 5/22/2000 gave an activity concentration of 29,180 nCi/L and on 5/30/2000 his tritium bioassay was 69 nCi/L – a reduction by a factor of 423 in 8 days. If the tritium were in equilibrium throughout his system, then such a reduction of tritium concentration corresponds to body half-time of less than 1 day – much faster than the normal 10 day body half-time.

(3) One possible explanation for the unusually high tritium bioassays is tritium contamination of the bioassay samples.

For example, handling the bioassay sample with a contaminated hand or a contaminated glove could introduce tritium activity into the sample bottle which would then result in an elevated tritium bioassay reading.

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Also, the service company that does the tritium activity measurement could contaminate the sample bottle if a tritium contaminated syringe was used to extract the liquid placed in the liquid scintillator counter.

(4) Another possible explanation for the unusually high tritium bioassays is a malfunction of the liquid scintillator counter at the service such that chemically induced photo emission is counted as beta particle stimulated emission from tritium.

I plan to have [REDACTED] high tritium bioassays analyzed by another service company that uses a different scintillator to check the results obtained by Microtec Services.

Recommendations

- (1) Introduce a signoff and review procedure for all station work that requires opening the Minitron processing station to the atmosphere. The planned station work would be reviewed and signed by the Tritium Technician, Tritium Engineer and the Radiation Safety Officer.
- (2) Return to the procedure of before and after bioassay samples for all open station work and Minitron dissections.
- (3) Number the bioassay samples in the order that they are to be analyzed. Then, control samples can be used to check for contamination at the service company that provides the tritium analysis.
- (4) Introduce a procedure to eliminate the possibility of contamination of bioassay samples.
- (5) Require that all vacuum components removed from the Minitron Processing Stations be labeled, assayed for tritium content, recorded, sealed, wipe tested, placed under hood, wipe tested after two-week interval, and, when the external surface shows less than 35 Bq/100 cm², placed in the radioactive waste drum.
- (6) Require that the Minitron Dissection Hood be cleaned and wipe-tested after every use, and that the sealed PVC pipe containing the dissected Minitron components be labeled, wipe tested, placed under hood, wipe tested after two-week interval, and, when the external surface shows less than 35 Bq/100 cm², placed in the radioactive waste drum.
- (7) Require that the Minitron Processing Stations be cleaned and wipe-tested after station work involving opening either the upper or lower manifolds to air.

