June 27th, 1979

Dr. Phillip Plato
The University of Michigan
School of Public Health
Department of Enivironmental
and Industrial Health
Ann Arbor, Michigan 48109

Dear Phil,

Thank you for the report on the site visits to the major dosimetry processors. I would like to comment on the report. The impression I received from the report is that there is absolutely nothing wrong with the standard. The reason for the high fail rate is that none of the processors are willing to exert enough effort. There was also some disturbing conclusions listed in the report that I would like to take up separately.

I was disturbed that Part III made no mention of clerical errors made by the contractor. There are at least four clerical errors by the contractor which caused us to fail two intervals. In your conclusion, does the 10% fail rate include clerical errors made by the contractor?

The most disturbing section of the report was Part IV. Although what you say might be true, the implication of what is said could be misleading. You state, "Many processors have not made a concerted effort to calibrate for the sources and procedures used in the pilot study, even after their results for Test No. 1." Since our name appears at the beginning of this report, one could be mislead to assume that we didn't make an effort to pass this standard. In fact, we have exerted over 100 man hours of work into devising a system paralleling our present system to calculate exposures made by the pilot study. If the standard is adopted, we will be ready to change our methods of calibration and calculation of exposure. No mention was made of the processors who made a sincere effort to pass the standard but still had problems with interpreting or correcting for the standard. We agree strongly that a standard should be adopted nationally and that there should be only one dosimetry standard.

For the most part, the personnel dosimetry industry is small with limited resources. There are no large groups of technical people standing around waiting to apply their efforts to passing the standard. For the most part, there are only a few qualified personnel in each installation to apply their skills. The positions that these people occupy also include other duties.

continued/. . . .

Nowhere in the report was any mention of the economic impact of such a standard. If dosimeter design is inadequate to pass the standard, new sources are purchased and more effort applied, the cost could easily exceed the annual profits of the processor. This could force some dosimetry processors out of the market place. To expect a processor to make expenditures of this magnitude to comply with a standatd that might be adopted in its present form is not realistic.

Overall, after reading the report, I hope that the NRC doesn't get same impressions I did. The report implied that most processors didn't exert enough effort and that the standard is perfect. If I were the NRC, I would move to adopt the standard as fast I could to force processors to comply. This action could have a devastating effect.

I believe that the best solution to this problem is for the NRC to design a film badge and a TLD badge and a dose calculation protocol for each that will meet the standard and license these designs to any processor. This approach would have several advantages:

1. Comparable results between processors
2. Lower cost and less complex testing program.
3. Could be implemented much faster.
4. Less risk of forcing some out of business and thus creating monopoly or oligapoly.
5. Substantially reduce cost burden to industry of implementation.
6. Would not change competitive position since that is based mostly on service aspects of business.

I hope that my comments on this report are helpful. If you have any question with respect to my comments, I would be more than happy to discuss them with you.

Sincerely yours,

Table 1. SUMMARY OF HPSSC STANDARD PREPARED BY THE UNIVERSITY OF MICHIGAN

	Radiation Category	Interval	Test Range	Number of Dosimeters Per Test	Tolerance Level (L) (see footnotes) Shallow (7 mg/cm^2)	Deep (1000 mg/cm^2)
I.	Gamma (Co-60)	1 Accident:	10-800 rad	10	no test	a
		2 Protection:	30-100 mrem	10	no test	b
		3	101-300 mrem	10	no test	b
		4	301-10,000 mrem	10	no test	b
II.	X Ray (30-300 keV)	1 Accide	10-800 rad	10	no test	a
		2 Protection:	30-100 mrem	10	c	c
		3	101-300 mrem	10	c	c
		4	301-10,000 mrem	10	c	c
III.	X Ray (15-30 keV)	Accident:	no test			
		1 Protection:	150-300 mrem	10	c	c
		2	301-10,000 mrem	10	c	c
IV.	Beta (Sr-90)	Accident:	no test			
		1 Protection:	150-300 mrem	10	c	no test
		2	301-10,000 mrem	10	c	no test
V.	Neutrons (Cf-252)	Accident:	no test			
		1 Protection:	100-300 mrem	10	no test	c
		2	301-5,000 mrem	10	no test	c
VI.	Photon Mixtures (Cat. I & II)	Accident:	no test			
		1 Protection:	50-100 mrem	10	c	c
		2	101-300 mrem	10	c	c
		3	301-10,000 mrem	10	c	c
VII	hoton and Beta ixtures (Cat. I or II & IV)	Accident:	no test			
		1 Protection:	200-300 mrem	10	c	c
		2	301-10,000 mrem	10	c	c
VIII.	Photon and Neutron Mixtures (Cat. I & V)	Accident:	no test			
		1 Protection:	150-300 mrem	10	no test	c
		2	301-5,000 mrem	10	no test	c

For each dosimeter, a performance index is calculated by:

$$P = \frac{H' - H}{H}$$ where: H = delivered quantity
H' = reported quantity

For each depth of each interval, an average performance index, $\bar{P}$, and its standard deviation, S, are calculated.

A processor passes a category if, for each depth of each interval:

$$|\bar{P}| + 2S \leq L$$

where:

a: $L = 0.3$
b: $L = 0.3$ or $6/\sqrt{H}$ whichever is larger
c: $L = 0.5$ or $15/\sqrt{H}$ whichever is larger

Table 2: PERFORMANCE TESTING OF PERSONNEL DOSIMETRY SERVICES

Summary of Results for Test #1 (first row) and Test #2 (second row)

Processor And Type	I: Gamma				II: High-Energy X Ray							III: Low-Energy X Ray				IV: Beta		V: Neutron		VI: Gamma plus X Ray						VII: Gamma plus Beta				VIII: Gamma plus Neutron	
	1D	2D	3D	4D	1D	2S	2D	3S	3D	4S	4D	1S	1D	2S	2D	1S	2S	1D	2D	1S	1D	2S	2D	3S	3D	1S	1D	2S	2D	1D	2D
1 TLD	P	P	F	F	F	F	P	F	F	F	F					P	P			P	P	P	P	F	F	P	P	P	P		
2 TLD	P	P	P	P																											
	P	P	P	P																											
3 TLD	F	P	P	P	F	P	P	P	P	F	F	F	P	F	P	P	P			P	P	P	P	P	P	P	P	P	P		
	P	P	P	F	P	P	P	P	P	F	F	P	P	P	P	P	P			P	P	P	P	F	F	P	P	P	P		
4 Film	P	F	F	F	P	P	P	P	P	P	P	P	P	F	F	P	F			P	P	P	P	P	P	P	P	F	F		
	F	F	P	P	P	P	P	F	F	P	P	P	P	P	P	P	P			P	P	P	P	F	F	P	P	F	F		
5 TLD	P	P	F	F	F	P	P	P	P	F	F	P	P	F	F	P	P	P	F	P	P	P	P	F	P	P	P	F	F	P	F
	F	P	P	F	F	F	F	F	F	F	F	P	P	F	F	P	P	F	F	P	F	F	F	F	F	P	F	P	F	F	F
6 Film	F	F	F	F	F	P	P	P	P	P	F	F	P	F	F	P	F	P	F	P	P	P	P	F	F	P	P	P	F	P	F
	F	P	P	F	F	P	P	P	P	F	F	P	P	F	F	P	F	P	F	P	P	P	P	F	F	P	P	F	F	F	F
7 TLD	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	F	F	F	P	P	P	P		P	P	P	F	F	F	F
8 Film	F	F	P	F	F	P	P	F	F	P	P	P	P	F	F	P	F	F	F	P	P	F	F	F	F	P	P	F	F	P	P
	P	P	P	F	P	P	P	F	F	P	P	P	P	F	F	P	F			P	P	F	F	F	F	P	P	F	F		
9 TLD	F	F	F	P	F	P	P	P	P	F	F					P	P	P	P	P	P	P	P	P	F	P	P	P	F	P	P
	P	P	F	P	P	P	P	P	P	F	F					P	F	P	P							F	P	P	F	P	P
10 TLD	F	F	F	F	F	P	P	P	P	F	F	F	F	F	F					P	P	P	P	F	F						
	F	P	F	F	F	P	P	P	P	F	F	F	F	F	F					P	P	P	P	F	F						
11 TLD	F	P	P	P	F	P	P	P	P	F	F									P	P	P	P	P	P						
	F	P	F	F	F	P	P	P	P	F	P									F	F	F	F	P	P						
12 TLD	F	F	F	F														P	P												
13 TLD	P	P	P	F	P	P	P	P	P	F	F	P	F	P	F	P	F	P	F	P	P	P	P	F	F	F	P	F	P	P	F
14 Film	F	F	F	F	F	P	P	P	P	F	F	F	F	F	F	F	F	P	F	P	P	P	P	P	F	F	P	F	P	F	
15 TLD	P	P	P	P	F	P	P	P	P	F	F	P	P	F	F	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F
16 TLD	F	P	F	F	F	P	P	P	P	F	F					P	F	P	P	P	P	P	P	F	F	P	P	P	P	P	P
	P	P	P	P	F	P	P	F	F	F	F					P	P	P	P	P	P	P	P	P	P	F	F	P	P	P	P
17 Film	F	P	P	F	F	P	P	F	F	F	F	F	F	P	F	P	F	F	F	P	P	P	P	F	F	P	P	F	F	P	F
	P	P	P	P	F	P	P	P	P	P	P	P	P	F	F	P	F	F	P	P	P	P	P	P	P	P	P	F	F	P	P

Note: Intervals shown under each category are defined in Table 1. Key: D = deep, S = shallow, P = pass, F = fail. Blank spaces indicate no participation in a particular category. For each category, a processor must pass each depth of each interval in order to pass the category.

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Summary of Results for Test #1 (first row) and Test #2 (second row)

Processor And Type	I: Gamma				II: High-Energy X Ray							III: Low-Energy X Ray				IV: Beta		V: Neutron		VI: Gamma plus X Ray						VII: Gamma plus Beta				VIII: Gamma plus Neutron	
	1D	2D	3D	4D	1D	2S	2D	3S	3D	4S	4D	1S	1D	2S	2D	1S	2S	1D	2D	1S	1D	2S	2D	3S	3D	1S	1D	2S	2D	1D	2D
18 TLD	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F	P	P	P	P	P	P	P	P	F	P	P	P
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
19 TLD	P	P	P	P																											
	P	P	P	P																											
20 TLD	F	P	P	F												P	P									P	P	F	F		
21 TLD	F	P	P	P												F	P									F	P	F	F		
	F	F	P	F												P	F									P	P	F	F		
22 TLD	F	P	P	F	F	P	P	F	F	F	P					P	F			P	P	P	P	P	P						
	F	P	F	F	F	P	P	P	P	P	P					P	F			P	P	P	P	P	P						
23 TLD	P	F	P	P	P	P	P	P	P	P	P	F	P	F	F	F	F	P	P	P	P	P	P	P	P	F	P	F	F		
24 TLD	P	P	P	P	F	P	P	P	P	F	F	P	P	F	F	P	P	F	F	P	P	P	P	F	P	P	P	P	F	F	F
	P	F	P	P	F	P	P	P	P	F	F	P	P	F	F	P	P	F	F	P	P	P	P	F	F	P	P	P	F	P	F
25 TLD																										P	P	F	P		
26 TLD	F	P	P	F																											
27 Film												F	F	F	F					P	P	P	P	F	F	P	P	F	P	P	F
																				P	P	P	P	P	P	P	P	F	P	P	F
28 Film	F	F	F	F	F	F	F	F	F	F	F									F	F	F	F	F	F						
29 Film	F	P	F	P	F	P	P	P	P	F	F	P	F	F	F					P	P	P	P	P	P						
	F	P	P	F	F	P	P	P	P	F	F	P	F	F	F					P	P	P	P	F	F						
30 TLD	P	P	P	F	P	P	P	F	P	P	P	P	P	F	F			F	F											P	F
	P	P	P	P	P	P	F	P	P	P	P	P	P	F	F			P	F											P	P
31 TLD	F	P	P	P								F	P	F	P	P	F									P	P	F	F		
	F	P	F	F								P	P	P	F	P	F									P	P	P	F		
32 Film	F	P	P	F												P	F														
	F	P	F	F												P	F														
33 Film	P	P	P	P	P	P	P	P	P	F	F	F	F	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P
	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	F
34 Film	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	F	F	P	P	P	P	P	F
	P	P	P	P	F	P	P	P	P	F	F	P	P	P	P	P	P	P	F	P	P	P	P	F	F	P	P	P	P		

Note: Intervals shown under each category are defined in Table 1. Key: D = deep, S = shallow, P = pass, F = fail. Blank spaces indicate no participation in a particular category. For each category, a processor must pass each depth of each interval in order to pass the category.

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	1D	2D	3D	4D	1D	2S	2D	3S	3D	4S	4D	1S	1D	2S	2D	1S	2S	1D	2D	1S	1D	2S	2D	3S	3D	1S	1D	2S	2D	1D	2D
35 TLD	F	F	F	F	F	P	P	F	F	F	F	F	P	F	F	F	F			P	P	F	F	F	F	F	F	F	F		
36 TLD	F	F	F	F								F	F	F	F			F	F	F	F	F	F	F	F					F	F
	F	F	F	F								P	P	F	F			F	F	P	P	P	P	F	F					F	F
37 TLD	F	P	P	P	F	P	P	P	P	P	P																				
38 TLD	F	P	P	P	F	P	P	P	P	P	P	F	F	P	F			P	F											P	F
	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P			P	P											P	F
39 TLD												P	P	F	P	F	F	P	P	P	P	P	P	F	P	P	P	F	P	P	P
40 Film		P	P	F		P	P	P	P	F	F	P	P	F	F	F	F	P	P	P	P	F	P	F	F	P	P	F	P	F	F
		P	P	F		F	F	F	F	F	F	P	P	F	F	F	F	F	F	P	P	F	F	F	F	P	P	F	P	P	F
41 TLD	F	P	P	P												P	P									P	P	P	P		
	P	P	P	P												P	P	F	F							P	P	P	P	P	F
42 TLD	F	P	P	P	F	P	P	P	P	P	F					F	F														
43 TLD	F	P	P	P	F	P	P	P	P	P	P	P	F	F	P	P	F	F	F	P	P	P	P	P	P	P	P	P	F	F	F
	F	P	F	F	F	P	P	P	P	F	F	P	P	F	P	P	P	F	F	P	P	P	P	F	F	P	F	P	F	P	F
44 TLD	F	P	P	P												P	F									P	F	P	F		
45 TLD																				F	F	F	F	F	F						
46 Film	F	P	F	F	F	P	P	P	F	F	F	P	P	F	F	F	F			P	P	P	P	F	F	F	P	F	P		
47 Film																															
48 TLD	P	F	P	F												F	F	P	F							P	P	F	F	P	F
	F	F	F	F												P	P	F	F							P	P	P	F	P	F
49 TLD	P	P	F	F	F	P	P	P	P	F	F	P	P	P	F	P	P	P	F	P	P	F	P	F	P	P	P	F	P	P	F
50 Film	F	F	P	P	F	P	P	P	P	P	P	P	P	F	F	P	F	F	P	P	P	P	P	F	F	P	P	P	P	P	P
51 TLD	F	P	P	F												F	F	P	F							F	P	F	F	P	F
	F	P	P	P												P	F	P	F							F	P	F	F	P	F

Note: Intervals shown under each category are defined in Table 1. Key: D = deep, S = shallow, P = pass, F = fail. Blank spaces indicate no participation in a particular category. For each category, a processor must pass each depth of each interval in order to pass the category.

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Processor And Type	I: Gamma				II: High-Energy X Ray							III: Low-Energy X Ray				IV: Beta		V: Neutron		VI: Gamma plus X Ray						VII: Gamma plus Beta				VIII: Gamma plus Neutron	
	1D	2D	3D	4D	1D	2S	2D	3S	3D	4S	4D	1S	1D	2S	2D	1S	2S	1D	2D	1S	1D	2S	2D	3S	3D	1S	1D	2S	2D	1D	2D
52 TLD	F	F	P	P	F	P	P	P	P	F	F							P	P							P	P	F	F	P	F
	F	F	P	F	F	P	P	P	P	F	F							F	F							P	F	F	F	F	P
53 Film	F	P	F	F	F	P	P	P	P	F	F	P	P	F	F	P	F									P	P	P	F		
54 (withdrew)																															
55 TLD																				P	P	P	P	P	P						
																				P	P	P	P	P	P						
56 TLD																															
57 TLD	F	F	F	F	F	P	P	F	F	F	F																				
58 TLD	F	F	F	F												F	P	P	F							F	P	F	P	F	F
	P	P	P	P												P	P	F	F							P	P	P	P	F	F
59 (withdrew)																															
60 TLD	P	F	P	F																											
	F	P	P	F																											
61 TLD	P	P	P	F	P	P	P	P	P	F	F					F	F			P	P	P	P	P	P	P	P	F	F		

Note: Intervals shown under each category are defined in Table 1. Key: D = deep, S = shallow, P = pass, F = fail. Blank spaces indicate no participation in a particular category. For each category, a processor must pass each depth of each interval in order to pass the category.

Table 3: PERFORMANCE TESTING OF PERSONNEL DOSIMETRY SERVICES

Summary of Results for Test #1 (first row) and Test #2 (second row)

Processor And Type	I: Gamma				II: High-Energy X Ray							III: Low-Energy X Ray				IV: Beta		V: Neutron		VI: Gamma plus X Ray						VII: Gamma plus Beta				VIII: Gamma plus Neutron	
	1D	2D	3D	4D	1D	2S	2D	3S	3D	4S	4D	1S	1D	2S	2D	1S	2S	1D	2D	1S	1D	2S	2D	3S	3D	AS	1D	2S	2D	1D	2D
70 TLD	F	P	P	F	F	P	P	P	P	P	P	P	P	F	F	P	P			P	P	P	P	P	P	P	P	P	F		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			P	P	P	P	P	P	P	P	P	P		
71 TLD	F	F	F	F																											
	F	F	F	F																											
72 TLD	F	P	P	F	F	P	P	P	P	F	F	P	F	F	F	P	F			P	P	P	F	P	P						
73 NTA																		F	F											F	F
																		P	F											P	F
74 TLD	P	P	P	P																											
	P	P	P	F																											
75 TLD	P	P	F	P	F	P	P	P	P	F	F	P	F	P	P	P	P			P	P	P	P	P	P	P	P	P	P		
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			P	P	P	P	P	P	P	P	P	P		
76 TLD	P	P	P	F		P	P	P	P	P	P							P	F	P	P	P	P	P	P					P	P
	P	P	P	P		P	P	P	P	P	P							P	F	P	P	P	P	P	P					P	P
77 Track Etch																		P	F											P	P
																		P	P											P	P
78 Albedo																		P	F											P	P
																		P	P											P	P
79 TLD	P	P	P	P																											
80 TLD																				F	F	F	F	F	F						
81 Albedo																														F	F
82 Ring	F	F	F	F	F	P	P	P	P	F	F																				
83 TLD	F	P	P	P	F	P	P	P	P	F	F	F	F	F	F	P	F			P	P	P	P	P	P	P	P	P	P		
	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P			P	P	P	P	P	P	P	P	F	F		
84 TLD	F	P	P	P	F	P	P	P	P	F	F	P	P	P	F	P	F			P	P	F	P	F	F	P	F	P	P		
	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P			P	P	P	P	F	F	P	F	P	F		
85 TLD	P	P	P	P																											
	F	P	P	F																											
86 TLD																															

Note: Intervals shown under each category are defined in Table I. Key: D = deep, S = shallow, P = pass, F = fail. Blank spaces indicate no participation in a particular category. For each category, a processor must pass each depth of each interval in order to pass the category.

Table 4. Summary of all intervals and categories passed for the open tests of Tests #1 and #2

Category	Test	Total No. of Processors	Percent Passing by Interval 1 Shallow	Interval 1 Deep	Interval 2 Shallow	Interval 2 Deep	Interval 3 Shallow	Interval 3 Deep	Interval 4 Shallow	Interval 4 Deep	by Category
I	#1	64		28%		67%		66%		42%	17%
	#2	41		45		80		70		50	38
II	#1	46		13	96	98	80	80	28	30	4
	#2	26		27	92	92	81	81	15	5	12
III	#1	33	67	58	27	18					3
	#2	24		92	46	54					42
IV	#1	42	71		33						33
	#2	27	89		59						56
V	#1	30		70		23					20
	#2	25		52		20					16
VI	#1	41	90	90	78	83	46	51			44
	#2	27	100	100	78	81	48	48			37
VII	#1	41	80	90	49	54					29
	#2	28	89	79	64	50					29
VIII	#1	31		71		26					26
	#2	25		68		36					32

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Test	Total No. of Categories Tested	Total No. of Categories Passed	Total No. of Intervals Tested	Total No. of Intervals Passed
#1	328	22%	917	54%
#2	223	33	607	67