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NIOSH's Criteria for a Recommended standard - Occupational Exposure to Waste Anesthetic Gases and Vapors...

comments. . .

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comments on a review. . .

In his review of Criteria for a Recommended Standard – Occupational Exposure to Waste Anesthetic Gases and Vapors, Mr. Fred Hertlein affords himself the luxury of diversing from his review to criticize NIOSH analytical methodology in general. We should like to formally respond to those criticisms contained in the paragraph beginning, "The NIOSH determination of desorption efficiency has always left a lot to be desired. . ." as well as directing some comments to other points in the review.

Mr. Hertlein is correct in saying that the desorption efficiency is half the "story" but is incorrect to state that the capacity "is rarely determined in practice." Part of NIOSH's standard protocol when designing sampling and analytical methods for gases and vapors using solid sorbents is to screen several sorbents for their ability to trap the contaminant of interest. The sorbent of choice is then subjected to breakthrough studies to determine the capacity of the sorbent for a particular contaminant. In the last three years NIOSH has expanded its standard protocol to include evaluation of sorbent capacity at 80% relative humidity, determination of breakthrough capacity at 2X the current OSHA standard for a given contaminant and recommendation that the maximum sample volume always be less than the breakthrough volume (usually 1/3 less). If a sampling method shows good capacity at high humidity, its chances of success in efficient collection are good. Lowering the recommended sampling volume ensures an additional margin of safety in collecting field samples where other contaminants are likely to compete for active sites on the solid sorbent. Further testing includes determination, not only of the desorption efficiency, but also of sample storage stability with time.[1]

Mr. Hertlein states that a known concentration in air is not necessary, "but only a known quantity has to be evaporated and drawn over the charcoal." Unfortunately, this oversimplifies the situation since it is reported that in fact, breakthrough varies with air concentration.[2,5] Merely pulling a known quantity, regardless of concentration, of contaminant onto a sorbent is not a true test of capacity.

In the "Documentation of the NIOSH Validation Tests,"[1] there are data on well over 100 compounds which clearly demonstrate that the NIOSH determination of desorption efficiency produces good results. In these tests the desorption efficiency was used to correct values of the samples from carefully generated contaminant-in-air systems. The correction produced numbers which were not statistically different from 100%.

Another NIOSH publication[3] reports the successful collaborative testing of seven solvents using the NIOSH charcoal tube method,[4]f once again establishing the validity of the desorption efficiency procedure.

We would agree that, in theory, it would be ". . .better to volatilize other substances. . . expected to be found. . ." but, in practice, accurate generation of multiple component atmospheres (particularly if the components are markedly different in properties) is difficult and very time consuming. Furthermore, it is not always clear what other components and their concentrations would be suitable test atmospheres. For this reason NIOSH researchers, from time-to-time, test various methods in field situations.

The review takes issue with sampling nitrous oxide on charcoal tubes. In fact, the criteria document recommends sampling volatile agents (halothane, trichloroethylene, methoxyflurane, etc.) on charcoal. Nitrous oxide, having a boiling point of −88°C (Table XIII-I of the criteria document) is a gas. The section titled Basis for Environmental Monitoring in Chapter V of the criteria document states direct infrared analysis of nitrous oxide is the most desired method.

The criticism of Table XIII-I is not entirely founded. The molecular formulae provide sufficient information to draw structures of the molecules and the proper isomer. We must apologize for the problem of not subscripting the numerical value of the elements in the formulae. Allowances must be made because of the method of typesetting – just as in the case of Mr. Hertlein's review of this document, there was no subscripting for the 2 in nitrous oxide.

We sincerely hope that these comments serve to help Mr. Hertlein understand this aspect of NIOSH analytical methodology. The errors Mr. Hertlein identified will be taken care of in future printing and revisions of the document.

Mary Lynn Woebkenberg
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references

1. **Taylor, D. G., R. E. Kupel and J. M. Bryant:** Documentation of the NIOSH Validation Tests, DHEW (NIOSH) Publication No. 77-185, GPO #1977-757-057/6708 (1977).
2. **Hill, R. H., Jr., C. S. McCammon, Jr., A. T. Saalwaechter, A. W. Teass and W. J. Woodfin:** *Anal. Chem. 48*:1395 (1976).
3. **Larkin, R. L., J. V. Crable, L. R. Catlett and M. J. Seymour:** *Am. Ind. Hyg. Assoc. J. 38*:543 (1977).
4. **White, L. D., D. G. Taylor, P. A. Mauer and R. E. Kupel:** *Am. Ind. Hyg. Assoc. J. 31*:225 (1970).
5. **Teass, A. W., C. S. McCammon, Jr., C. P. Roper and A. T. Saalwaechter:** Second NIOSH Solid Sorbents Roundtable, DHEW (NIOSH) Publication No. 76-193, GPO #1976-657-696/5582 (1976).

reviewer's rebuttal. . .

Mrs. Mary Lynn Woebkenberg's comments regarding my review of the NIOSH criteria document on waste anesthetic gases and vapors for you have been reviewed and I am very appreciative for the opportunity to reply. I cannot agree that I afforded myself the "luxury of diversing from" my review since the analytical methodology is so much a part of the document. I would have digressed in this same manner on any other document that expounds the use of an analytical method about which I have reservations.

A case in point concerns a discussion I had recently with an ex-NIOSH employee at a chemical conference which indicates that there is not much interchange of dialogue between NIOSH criteria document writers and NIOSH analytical chemists. This is well borne-out in the sampling and analytical procedure specified for organo tin compounds in the NIOSH organo tin criteria document. The sampling and analytical procedures reported were simply not verified or confirmed and, as such, should not have been published without a more critical prior review. I guided a University of Hawaii graduate student on a research project in this organo tin area for many months before it became obvious that we should suspect some of the statements made. Thus I stress again that critical comments made in these areas are not a "luxury."

Mrs. Woebkenberg's comments do indeed clarify NIOSH's justification of using only the "desorption efficiency" instead of the "overall efficiency" which is the total effect of the "desorption efficiency" and the "adsorption efficiency." If her references indicate that the desorption efficiency is essentially the same as the overall efficiency, then I agree that this matter can be greatly simplified by using the easier to determine desorption efficiency. The point I was attempting to stress is that even the desorption efficiency is not generally determined by practicing industrial hygienists in the field. When charcoal tube samples are obtained, they are simply sent in to a certified IH laboratory (together with a blank) and the total quantity of a particular analyte is determined. A desorption efficiency correction is rarely made since NIOSH has found that in many instances they approach 100% efficiency. Yet this does vary depending on the type or source of carbon used in the charcoal tube, the granular size of the charcoal, the effect of other solvents and vapors on the main one under consideration, etc. etc.

Accurate generation of multiple component atmospheres is indeed difficult and time consuming, but what is the alternative to this? It would appear that if field data is to be carefully scrutinized in a court of law, these short-comings will be pointed out and this could jeopardize the validity of all such measurements. Thus the determination of the desorption efficiency for a particular substance in the presence of several other substances by each individual in the field may in the long run be not as time consuming as originally stated by Mrs. Woebkenberg.

It is heartening that NIOSH received my critical comments in an atmosphere of constructive criticism since this is indeed the manner in which they are intended.

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Correct abbreviated symbol for liter(s). . .

Despite repeated reference to sources of correct metric practice published frequently in AIHAJ in the "guidelines for authors. . ." and specific mention of the proper form for the abbreviation of "liter(s)" included in Table V on page A-26, *Am. Ind. Hyg. Assoc. J.*, May, 1977, in the article, "Metrication and AIHA. . .", by Ronald C. Burnett, Major, USAF, AIHA's Metrication Coordinator, authors continue to err in original manuscript preparation.

Even worse, when the editor corrects the manuscript to conform to the newly accepted and proper form, authors return their galley proofs with corrections marked for conversion back to the original *incorrect* submission. These markings must be deleted before releasing the galleys to typesetting for final pre-publication correction of actual errors.

The correct and only acceptable abbreviation for the term "liter(s)" standing alone or separated from another term in any way is a capital "L", **NOT** a script lower case "l", or a conventional lower case "l". While not technically correct, according to strict interpretation of the accepted form, usages such as "ml" are acceptable. Properly, "mL" should be used.

Authority for this stipulation appeared in the *Federal Register*, Vol. 41, No. 239, Friday, December 10, 1976, on page 54019. Table 6 shows the symbol for "liter" as "L", with a footnote reading:

> *"The international symbol for "liter" is the lower case "l", which can easily be confused with the numeral "1". Accordingly, the symbol "L" is recommended for United States use."*

Authors are urged to observe proper usage in the preparation of new manuscripts and to follow the same practice in the checking and mark-up of galleys typeset from manuscripts now in the hands of AIHAJ, as these move into the publication process.