pre-supernovae isotopic compositions and by investigating what other observable effects would result from such a neutron burst. These may well be limited to the other noble gases; effects on other elements may be masked by their much greater normal abundance. The superheavy element suggestion of Anders *et al.*[5] of course remains a possibility.

We thank D. Black and E. Anders for useful comments. This work was supported in part by NASA and the NSF.

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Elevation of selenium levels in air by xerography

THE report on this subject which appeared in *Nature*[1] raises questions of methodology and relevance which I discuss here.

Although the authors calculate airborne selenium concentrations between 2×10^{-8} and 6×10^{-8} g m^{-3}, a simple calculation based on the data presented yields a concentration range 4.9×10^{-9}–14.7×10^{-9} g m^{-3}. Of more concern is the sensitivity of the analytical methods used. Their prime reference[2] reports "precision and accuracy are good for Se levels down to about 0.1 p.p.m. (1×10^{-7} g per determination) and acceptable for many purposes to 0.02 p.p.m. (2×10^{-8} g)" and reagent blanks ranging from 2 to 2.3×10^{-8} g selenium per determination. Using Olson's method[2], Harkin *et al.*[1] reported collection of from 5×10^{-9} to 15×10^{-9} g of airborne selenium in a xerography room. These values are clearly below Olson's own sensitivity limit and are even below Olson's blanks[2]. Harkin has made assurances (personal communication) that Olson's methods have been improved on and that the values reported are in excess of blanks, but the precision and accuracy of Harkin's data cannot be verified by the methods cited.

Even assuming Harkin's results are valid, some perspective is appropriate. The highest selenium concentration reported[1] (6×10^{-8} g m^{-3}) is 3,333 times lower than the US Occupational Safety and Health Agency (OSHA) limit[3] (2×10^{-4} g m^{-3}). If one assumes a human minute volume of 8.2 l (ref. 4) and total absorption of inspired selenium[5] at the highest level reported, the total selenium ingested by inhalation in an 8-h day (2.4×10^{-7} g) would be 27 times less than that ingested by consuming a single 23-g slice of white bread (6.4×10^{-6} g)[6]. Selenium, incidentally, is considered as a nutritionally essential trace element[7].

We have measured selenium emissions from Xerox machines and have found them to be several orders of magnitude below the OSHA limit and below the usable limit of our analytical methods. Since the question has been raised, however, we have initiated a renewed effort externally to ensure that we have the most accurate data possible.

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HARKIN ET AL. REPLY—Fluorimetric analysis of selenium using 2,3-diaminonaphthalene (DAN) is easily sensitive enough to determine the levels we collected from air. The sensitivity claimed[1] for the method is very conservative and can be improved by slight modifications of the basic procedure[2]. These include recrystallisation of the DAN reagent, extraction of the fluorescing Se–DAN complex with cyclohexane rather than with decahydronaphthalene, and extension of the digestion time with perchloric–nitric acid to 90 min following the first appearance of perchloric acid fumes. Sensitivities of 1 ng and <4 ng have been claimed for blank analyses by others[3,4]. Our blank values lay reproducibly at 4.7 ± 0.7 ng Se.

The question[5] of the sensitivity of the method is not really pertinent, since the figures we reported[6] were for levels above values measured in control experiments using air samples collected in laboratories in the same building as our copying room. Because the values were low for single-day air samples, to increase the reliability of the analyses, cumulative samples taken over 4 d were actually analysed, but values were supposed to be expressed on a daily basis. Omission of the word "daily" after the values of 0.005–0.015 ng in the report[6] made them seem to be the 4-d total rather than single-day averages. The value of 20–60 ng Se per m^3 of air is the correct, rounded-off figure for the airborne Se levels.

Tolerable limits for exposure to selenium depends on the Se species concerned, and some reappraisal of current values may be warranted. The time-weighted average concentration of 0.2 mg m^{-3} permitted by the OSHA for elemental selenium and selenium oxides in air differs from the value for hydrogen selenide, which at 0.05 p.p.m. is 200 times lower than that for hydrogen cyanide, which is generally considered to be the most highly toxic common airborne inorganic compound[7]. Russian workers recently suggested that the permissible limits for SeO_2 should be reduced to 0.1 μg m^{-3} in air for a single exposure and to 0.05 μg m^{-3} in air for average daily exposure[8].

Comparison of inhaled and ingested selenium is of doubtful validity in the absence of toxicological work directed at this specific question. There is, in fact, evidence that selenium administered in the oxidised form can be excreted in part by respiration as volatile methylated derivatives[9].

Although excess selenium may be harmful under ordinary circumstances, its beneficial effects in counteracting heavy metal toxicity should not be overlooked[10–13]. Since there are many questions of selenium biochemistry and metabolism still unanswered, the effects of minute volatile emissions from copiers cannot be predicted with confidence. We appreciate the efforts of copier manufacturers to ensure that these emissions will be kept to a minimum and checked by independent analyses.

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