

SNO-STR-94-034

LBL/LBF
8/10/94
Rev. 9/25/94

A.R. Smith
D.L. Hurley
R.J. McDonald

RADIOACTIVITIES IN MAGNESIUM CHLORIDE: SNO SAMPLES

Two large samples of $MgCl_2$ (10 Kg each from Aldrich and from Merck) have been sent to the LBL Low Background Facility for analysis of gamma-emitting radionuclides. The high sensitivity and very low BKG of our MERLIN II system (at Oroville) are required to measure concentrations down to the "safe" upper limits calculated for use of this compound as a solute in the heavy water of the SNO detector.

We were requested to provide measured concentration values at the level of 1 ppm for K (elemental), and sub-ppb concentration values for U and Th. The MERLIN II system has these capabilities when used with large amounts of sample material: in this case, with about 5 Kg of the compound. The sample container is a two piece assembly: a 7-in O.D. annulus that is 8-in high and fits around the detector "endcap", plus a 7-in diameter by 2-in thick disc that fits on top of the "endcap". The (U,Th,K) calibration parameters for this large sample format were determined through use of expanded mica (vermiculite) of known radiometric content.

The sample container, originally made for calibration of the "geometry" to be used for counting SNO Rope samples, was not built of the least radioactive materials available. A new container will be built for analysis of any additional $MgCl_2$ samples beyond the two already in hand at LBL.

The MGCL2 sample from Aldrich has now been analysed, with the following results. The U-content and Th-content were observed only as upper limits, while the K-content was determined to have a real value. The U- and Th- limits represent one standard deviation (SD), derived from the counting data. The actual BKG was not just the system BKG as we would prefer, but also included a contribution from the counting container. The uncertainty in the K-content is also expressed as one SD on the counting data. Results obtained from the Aldrich sample of MGCL2, weighing 4717 grams and counted for 9542 minutes (a week) with our MERLIN II system are:

Potassium	3390	+ - 230	ppb
U-series		+ - 65	ppt
Th-series		+ - 240	ppt

As per our telephone conversation last week, we will make our Oroville Facility available for analysis of both "feed stock" and "purified" MGCL2 samples, if this chemical is your choice for use in the SNO detector. The same offer applies to a reasonable number of other "candidate" chemicals, in the event MGCL2 is judged not to be acceptable.

9/25/94: ADDITIONAL RESULTS

Analysis of the Merck sample of MgCl2 at our Oroville Facility has been completed. A 4626 gram quantity of the chemical was counted for 8095 min, in the same "geometry" as for the Aldrich sample. Results are as follows:

Potassium	2470	+ - 230	ppb
U-series		+ - 70	ppt
Th-series		+ - 245	ppt

The potassium content of MgCl2 from Merck is definitely lower than that from Aldrich - - based on only one sample from each supplier. We cannot be tell whether this difference is systematic or fortuitous, based on such limited information. Perhaps it is not important for your purpose, since the difference is not large in the relative sense.

Please keep us informed of your needs for future radiometric analyses, so we can plan how best to work your samples into our counting schedule at Oroville. For the immediate future, SNO ROPE samples have top priority, but it is not known how many samples there will be, nor when they will appear - - beyond the one now counting.