Below we present a point-by-point response to the reviews, including a list of all relevant changes made in the manuscript.

Reviewer comment	Author's reply to comment	Changes made
RC1: Line 130 The formulation "the most radiotoxic elements" is not sufficiently precise. While it is true that Pu and Am isotopes are among the most radiotoxic substances on a per-mass basis when incorporated into the human body, their activity concentrations in the environment are typically very low. As a result, their actual impact on human health under natural environmental conditions is negligible, except in cases of nuclear accidents. It would be more accurate to state that they are "among the most radiotoxic elements."	This is a very accurate remark which will help to clarify this part of the text. We will, of course, revise the phrase as suggested.	Line 122 in the manuscript with marked changes.
RC1: Line 204 The manuscript states that "the set of weekly air filters was delivered from the Polish Polar Station in Hornsund, Svalbard Archipelago, to the National Centre for Nuclear Research (NCBJ) in Świerk, Poland." However, the text does not clearly indicate whether the filters were actually sent to Poland every week, or whether shipments coincided with the rotation of polar station personnel and supply missions, which typically occur only a few times a year. This information is particularly important for short-lived radionuclides such as 7Be, as significant delays between sample collection and analysis can result in considerable activity losses and may affect the accuracy of the results.	The filters are sent to NCBJ for analysis three times a year, in April, July and September. This is related to the organisation of transport from the Polish Polar Station in Hornsund. Therefore, it was necessary to recalibrate data from Hornsund due to radionuclide decay. As the manuscript explained, correction factors were used for all the gamma emitters because of decay during sampling, decay from the end of sampling to the start of measurement, and decay during measurement. We are aware that the measurement uncertainty for Be-7 is higher, but this does not imply that the result is erroneous. Specifically, the loss of activity in Be-7 does not affect the reliable determination and identification of the annual variability of this radionuclide. At this time, we have no other way to take gamma measurements.	No changes in the manuscript.
RC1: Line 220 Due to low concentrations, the samples were aggregated on a quarterly or semi-annual basis. While this approach is technically understandable, it significantly limits the ability to detect short-term incidents and to link them to specific meteorological events or emission episodes. I recommend that the authors explicitly acknowledge this limitation in the manuscript.	Thank you for this accurate observation. Indeed, a database based on quarterly results suffers from low resolution. The reason for our decision was explained in the Materials and Methods section. However, we will emphasise this problem more strongly in the discussion of the results and conclusions.	Lines 540-542 in the manuscript with marked changes.
RC1: Line 279 While the application of Tukey's interquartile range (IQR) method with a conservative multiplier (k = 3) is a well-established and robust approach for detecting statistical outliers, it may have certain limitations when applied to highly dispersed and temporally aggregated environmental data, such as quarterly-averaged radionuclide concentrations. In	We appreciate the suggestion to use additional time series analysis methods. In our study, we used the Tukey IQR method (k = 3) to identify outliers when preparing the dataset for Spearman rank correlation calculations. Removing outliers at this stage was a technical step motivated by the need to reduce the influence of a small number of very high values on the correlation results, given the relatively	Lines 295-296 in the manuscript with marked changes.

such cases, individual extreme values often reflect true episodic events (e.g., sudden contaminant influx, wildfire transport, or atmospheric resuspension episodes) rather than errors or measurement artifacts. The IQR method, which does not consider temporal context or trends, may misclassify these scientifically relevant episodes as statistical outliers and overlook underlying regime shifts or changes in baseline levels. Therefore, it could be beneficial to consider supplementing the IQR analysis with additional time series methods—which are well suited to identifying genuine shifts or episodic changes in environmental data.	small number of observations in the quarterly-aggregated time series. We would like to emphasise that labelling a point as an 'outlier' in the statistical analysis did not mean excluding it from scientific interpretation. All such cases were included in the discussion section, analysed in the context of meteorological conditions and possible sources of contamination, and presented in Figures 3–4 as potentially important environmental episodes.	
RC1: Line 319 I suggest that Table 1 should also include information on the measurement uncertainty, particularly if the filters were analyzed after a significant storage period. If there was a substantial delay between sample collection and measurement, the decay correction and its associated uncertainty could have a notable impact on the final results—especially for radionuclides with shorter half-lives	Of course, we understand the importance of measurement uncertainties accompanying the values of the parameters studied. All uncertainties in the raw data (gamma and alpha emitters) are presented in the open-access database linked to the manuscript: https://doi.org/10.48733/no6.25.015. We would therefore prefer not to add this information to Table 1, which presents descriptive statistical results. In addition, we propose adding information about where detailed results and uncertainties can be found in the caption of Table1.	Line 301 in the manuscript with marked changes.
RC1: Line 345 While the general patterns of 210Pb and 7Be in the lower atmosphere are similar, it is worth noting that, in the case of 210Pb, local emissions related to fuel combustion at the station during winter may also contribute to the elevated concentrations observed in this period	Certainly, heating the station affects the local Pb-210 concentration in the air. However, the heating season is quite long, particularly in the first and fourth quarters, so it is difficult to clearly link the fuel combustion at the station to the maximum Pb-210 in the first quarter.	No changes in the manuscript.
RC1: Line 355 The outliers result from the application of Tukey's method, as noted in the comment described in line 279.	Yes, and this method revealed outliers that could be related to incidental events, such as the Fukushima accident. These outliers are distinct from typical variability, which is determined by natural phenomena.	Lines 295-296 in the manuscript with marked changes.
RC1: Line 569 Additionally, military activities in Ukraine in 2022 may have contributed to a temporary increase in airborne 137Cs, as observed across Europe.	This is generally possible, but 2022 is outside the studied sampling period. Air filter samples were taken between 2007 and 2021. We intended to include nuclear events that took place before and during the mentioned period.	No changes in the manuscript.
RC2: There are Table S1, S2,,,,S7 and Fig. S1,,,,S5 are cited in the text, but cannot be found in paper?	Yes, the mentioned tables and figures are cited in the text. Tables and figures numbered with the letter S are located in a separate file called 'Supplementary material'.	No changes in the manuscript.
RC2: Starting from line 488, the author states "strong correlations were obtained...". In fact, I cannot see these	While Figure 4 attempts to illustrate the results of descriptive statistics in quarters, Table 4 presents the results of cross-correlations in	Lines 450-451, 454-455 and 457-458 in the manuscript

correlations in Figure 6, nor can I find these strong correlations in Table 4, except for the strong correlation between 239+240Pu and 241Am in the third quarter.	quarters for the radionuclides studied. As stated in the manuscript, strong correlations are highlighted in bold and marked with an asterisk *. We have verified that this table is correctly presented in the manuscript PDF file posted by the EGUsphere. For better clarity, we will add information on how strong correlations are marked in the description of Table 2-4.	with marked changes.
RC2: It is recommended that the 238Pu/239+240Pu and 241Am/239+240Pu ratios obtained from other studies be added to Figure 7 and represented with different colours or shapes for easy comparison.	Naturally, we understand the need for a visual comparison of the Hornsund activity ratio results with those from other stations. Such a comparison is presented in the 'Results and Discussion' section. Due to the infrequent analysis of Pu-238, 239 and 240, or Am-241, in air filters, comparative data is generally scarce. Furthermore, data from other stations often refers to a different sampling period than the one we studied and to filters that are aggregated differently (i.e. not quarterly). Therefore, we feel that adding further data points from other stations to Figure 7 would be inconsistent with the manuscript section that discusses the data comparison in more detail and provides contextual information. We sincerely hope that our points of view will be found convincing.	No changes in the manuscript.

Below, we describe additional changes made in the manuscript.

We decided to add new information to section 3.4 Potential origin of radioactive contamination, which enriches the discussion with new information:

Lines 527-534: information on Chernobyl wildfires in 2015 coinciding with Pu peaks.

Lines 559-568: information on undeclared nuclear activity.