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This is a translation of the letter entitled “Radioaktives Inventar in der Schachtanlage ASSE II Beratungsergebnisse und Empfehlungen der Ad-hoc-Arbeitsgruppe ASSE der ESK und der SSK”.

In case of discrepancies between the English translation and the German original, the original shall prevail.

Radioactive inventory in the ASSE II mine

Consultation results and recommendations of the ASSE ad hoc working group of the Nuclear Waste Management Commission (Entsorgungskommission, ESK) and the Commission on Radiological Protection (Strahlenschutzkommission, SSK)

At the 6th meeting of the ESK/SSK ad hoc working group ASSE on 21.09.2009, the BMU requested the ESK/SSK ad hoc working group ASSE to provide a summary of the current status of discussions regarding the radioactive inventory in the Asse mine. The facts and circumstances presented in the following have been discussed in the meetings of the ESK/SSK ad hoc working group ASSE several times in the presence of different authority representatives. Questions relating to the chemical inventory are not dealt with in the following.

1 General overview

From the start of its work in summer 2008, the ESK/SSK ad hoc working group ASSE had considerable doubts regarding the consistency of the Asse inventory at that time. These are already found in the ESK/SSK statement of 17.09.2008 on Pages four to eight in the chapter “Eingelagertes Radionuklidinventar” on emplaced radionuclide inventory.

The 2002 inventory showed greater deficiencies. Its authors tried, in addition to the evaluation of the consignment notes, to interview the respective companies delivering but the response to the questioning was very low.

According to the ESK/SSK ad hoc working group ASSE, the deficiencies are due to the following causes:

- In some cases, only exemplary nuclides or reference nuclides were stated in the declaration prior to delivery. More specific nuclide spectra that are behind the exemplary nuclides or reference nuclides can no longer be generated reliably. It is only possible to draw conclusions by analogy on the basis of common nuclide spectra.
- In the declaration prior to delivery, nuclides were forgotten that had been known. Here, subsequent declaration is only possible where evaluable documents are still available from the deliverer. Moreover, the calculation of the daughter nuclides in the ²³²Th decay chain included a calculation error with considerable influence on the inventories of ²²⁸Ra.
- In the declaration prior to delivery, nuclides were forgotten whose existence actually should have been clear due to physical or chemical aspects. However, the producers of the consignment notes did not

record them, probably for lack of knowledge or insufficient depth of consideration. Such cases can be corrected if corresponding considerations are made in the review.

- The content of packages had been incorrectly declared deliberately. In these cases, the deliverer at that time will probably have no documentation of the real facts. As far as contemporary witnesses can be interviewed, it is relevant for the reliability of their statements if they have a motive and the knowledge to correct the deliberate wrongful declaration of that time.

The ESK/SSK ad hoc working group ASSE knows that meanwhile work is being performed in form of working groups to prepare a review of the inventory. However, to which extent considerations of the ESK/SSK ad hoc working group ASSE will be taken into account is not known to us.

2 Referring to individual nuclides

2a Plutonium

In their statement of 2008, ESK and SSK still assumed that the waste from the Karlsruhe Reprocessing Plant (Wiederaufarbeitungsanlage Karlsruhe, WAK) only includes plutonium. Meanwhile it has become known that plutonium is included in another waste stream originating from the operation and, in particular, the clearing out of laboratories operated in the Forschungszentrum Karlsruhe (FZK) in the past.

From the point of view of the ESK/SSK ad hoc working group ASSE, it should also be checked whether streams of other waste deliver may contain plutonium due to their origin.

2b Tritium

In their statement, ESK and SSK already pointed out that the tritium inventory assumed in the past is hardly consistent with the tritium release measured. On the initiative of the ESK/SSK ad hoc working group ASSE, further elaborations are now available. On the basis of French experiences and experiences made in Jülich it is shown that tritium is generated in the graphite used in the reactor due to nuclear physics processes. Initial products were chemical components that exist in the graphite due to manufacturing. Both estimates lead to considerably higher tritium inventories and are generally in good quantitative agreement.

2c Further isotopes due to activation of impurities in graphite

It is to be pointed out that for graphite, the inventories of the isotopes ^{14}C , ^{36}Cl and ^{41}Ca also have to be checked due to impurities from manufacturing.

2d U and Th inventory and consideration of radionuclides of the decay series

The statement of ESK and SSK already points out to questions regarding the Th inventory and regarding the calculation for determining radionuclides of the natural decay series. Since, in particular regarding ^{228}Ra , it is not a matter of discretion but of faulty workmanship, the inventory corrected accordingly should be used for all other work.

2e Referring to the inventory of other waste

The wastes from reprocessing might have higher contents of neptunium and other nuclides due to the less effective separations in the cleaning stages, which possibly also requires corrections of the uranium and plutonium inventories.

As far as there was high-grade steel as material from fuel elements reprocessed in Karlsruhe, the question arises whether alloying elements, such as silver and cobalt, led to an inventory of radioactive decay products, such as ^{110}Ag , $^{60-58}\text{Co}$, $^{59-63}\text{Ni}$, $^{55-59}\text{Fe}$, ^{65}Zn

For ion exchange resins from nuclear power plants, there might be underestimations of ^3H and ^{14}C .

3 Indications of incorrectly declared packages

3a Incorrectly declared inventories for drums intended for Asse

At its 13th meeting on 15.02.2001, the former RSK Committee on FUEL SUPPLY AND WASTE MANAGEMENT (VE) thoroughly dealt with the false declarations in Geesthacht revealed at that time. The respective report of the authority in Schleswig-Holstein showed clear false declarations for packages intended for emplacement in the Asse. Only two of the 28 packages re-opened then had been declared correctly in full, ten correctly to a large extent, but humid with internal corrosion, and 16 incorrectly to a large extent. The corresponding deliverer had been a well-known company at that time.

The ESK/SSK ad hoc working group ASSE assumes that qualitatively similar false declarations may also exist for drums emplaced in the Asse to an extent that cannot be determined. Hence, the drums examined in Geesthacht at that time are to be regarded as sample inspection which showed that in several cases, there were clearly incorrectly declared packages. From this, however, it is difficult to draw quantitative conclusions regarding the percentage of packages with false declarations.

3b Incorrectly declared drum of NPP waste in Asse

In a note of 1980 on an accident occurred during transport of drums from Chamber 7 into Chamber 6 at the 750-m level it is stated that one drum – probably from the plant operator's inventory – did not contain the solid material as specified but a "black relatively liquid mass". To which extent the

declaration of the inventory had been correct despite the false declaration of the consistency is not known to the ESK/SSK ad hoc working group ASSE.

4 Conclusions

Regarding the current reliability of the inventory, the ESK/SSK ad hoc working group ASSE draws the following conclusions:

- When preparing an inventory for questions related to the long-term safety case, it is to be ensured by appropriate considerations that potential uncertainties resulting from the issues mentioned do not have a significant influence on decision-relevant results of the long-term safety assessment.
- This equally applies to all generic considerations regarding the assessment of options and the comparison of options. This applies, in particular, to the assessment of achievable reductions of risks.
- When using the inventory for questions related to the planning of measures that depend on the local distributions of the inventory, possible bandwidths are to be weighed up very carefully. This applies, for example, to shifting of packages or clearing out of individual emplacement chambers influencing the releasability of partial amounts of the inventory.
- The overall consideration (summation of the activities) does not allow drawing a conclusion to individual packages from individual chambers for the measures of occupational health and safety and radiation protection. This inevitably implies that for planning and performance of work with packages, the most unfavourable boundary conditions, including an uncertainty due to a potential false declaration, have to be assumed by way of precaution.

These statements represent the current status of discussions in the ESK/SSK ad hoc working group ASSE.