COBALT (II) DINITRATE

Answer to the public consultation initiated by the European Chemicals Agency

EDF SA

Uses:

1) First of all, cobalt (II) dinitrate hexahydrate is used on EDF nuclear power plants within the monitoring laboratories to check the condition of fuel cladding, in order to determine the amount of caesium present in the water and in contact with the fuel assemblies. Cobalt (II) dinitrate is used as a reagent for the analysis tanks to the precipitation of cobalt process. Caesium-137 and caesium-134, generated by the radioactive fission during nuclear reactor operation, can be efficiently measured and monitored using this procedure.

The use of cobalt (II) dinitrate by EDF is limited to in-laboratory measurement and monitoring procedures:

- in the primary coolant liquid samples analyzed in the nuclear power plant laboratories,
- in the liquid samples taken from spent fuel pools within the fuel building in the nuclear power plant laboratories.

In the presence of high cobalt (cobalt 58 and cobalt 60) isotope activities, caesium gamma rays are hidden. Using gamma ray spectroscopy, it is sometimes difficult to measure with sufficient accuracy the activities of caesium 134 and caesium 137 in order to be able to calculate their ratio. In such a case, it is of vital importance that precipitation of cobalt be carried out prior to the activity measurement using gamma-ray spectroscopy, with the device usually used on-site. The aim of this process is therefore to extract the cobalt isotopes of cobalt to be analysed by implementing precipitation using cobalt salts. The cases when a precipitation of cobalt process should be implemented prior to the measurement of caesium activity remain exceptional, making the implementation of this process particularly rare.

2) The second use of cobalt (II) dinitrate is under a liquid form and only related to the analysis procedures carried out within the EDF corporate laboratory, i.e. the Ceidre/DLAB .
A cobalt (II) dinitrate solution of 1000 mg/L is used as a calibrator in the procedures using inductively coupled plasma atomic emission spectroscopy (ICP/AES).
These procedures simultaneously determine the quantity (amount) of various substances (phosphorous, chrome, molybdene, manganese, vanadium, copper, nickel, arsenic, tin, cobalt, iron, silicon, aluminium, titanium and boron) within alloyed or unalloyed, as well as in nickel-based alloys. The cobalt (II) dinitrate solution is used at a maximum dilution rate of 1mL per 100 mL.

Amounts :

1) For cobalt (II) dinitrate hexahydrate in solid form, the amounts used annually by nuclear power plants to check the behaviour of fuel are very low, ranged from 50 and 100 grams per year. Given the necessary amounts described by the precipitation of cobalt procedure and the possibility of keeping cobalt (II) dinitrate bottles open for a duration of up to 5 years, we calculate the use of the substance to be approximately 2.5 g of cobalt (II) dinitrate per power plant per year. For 20 power plants, the amounts used can therefore be estimated to 50 grams of cobalt (II) dinitrate per year. Considering an error margin of 2, we estimate the total amount of cobalt (II) dinitrate used by our power plants to be approximately 100 grams per year.

2) For cobalt (II) dinitrate in the liquid form, as used in the calibrator solutions for metal analysis plasma spectrometry techniques, the amounts purchased are, again, minute and restricted to the Ceidre/DLAB analyses. According to the information supplied by the Purchasing Division, quantities of cobalt (II) dinitrate ordered were as follows:

- 200 ml for the year 2009,
- 500 ml for the year 2010.

The amounts purchased are a good indicator but must nevertheless be kept distinct from amounts consumed, which are necessarily smaller than those indicated in this first estimate.

Substitution:

Substitution studies have already been conducted by EDF and are currently in progress into further detail to find an alternative to the use of cobalt (II) dinitrate in the precipitation of cobalt process.

EDF is currently continuing its substitution research but no substance tested and analyzed has, today, fully fulfilled the conditions required in efficiency on the one hand, and in worker protection on the other hand.
The latest substitution studies for cobalt(II) dinitrate have not yielded any promising results.
Two products with identical characteristics have been identified. These are cobalt (II) oxide (CoO) (CAS no. 1307-96-6) and cobalt sulphide (CoS) (CAS no. 1317-42-6). Both substances were rejected because they presented genuine hazards for the safety of workers.

EDF is continuing its R&D work in order to identify a substance that can efficiently substitute cobalt (II) dinitrate in its procedures, without any risk for workers and the environment.

Risk management:

Handling instructions for cobalt (II) dinitrate within the EDF power plants are clearly defined and very strict.

Handling is completed under a hood. Workers are required to wear all of the following: protective clothing that withstands acids, respiratory protection against fumes or aerosols, safety goggles and protective gloves. These equipments perfectly meet the requirements of directive CE 89/686/CEE, bringing together the national provisions regulating Personal Protective Equipment (PPE) and the corresponding EN374 standard that specifies a test method to check the resistance of protective gloves against the penetration of chemical products and/or micro-organisms. The information, instructions and appropriate training measures are made available to workers handling the substance.

Likewise, storage instructions in place are strict on the EDF power plants. The substance must be kept in a sealed container and stored in a well-ventilated location, kept at a constant temperature between +15°C and +25°C. This stock is locked in highly secure boxes in a location that can only be accessed by qualified or authorized personnel.

Further, EDF makes sure its laboratories follow the very clear instructions regarding containment and cleaning methods. The disposal of waste is carried out according to the national regulations in place, which in turn respect the directive of the European Parliament relating to waste, 2008/98/CE. The laboratories must leave the chemical substance in its original container. It is strictly prohibited to mix it with other waste, and the treatment of non-cleaned containers is identical to the treatment of the product itself.
On-site laboratories handling cobalt (II) dinitrate are requested to collect and pump all products that may be spilled. Specific procedures are also in place in the event of container leakage.

In order to ensure their efficiency, these measures for the prevention of risk to workers and the environment when using cobalt (II) dinitrate are clearly explained in the local data sheets, which are drafted from safety data sheets.

Conclusion:

EDF uses only very small amounts of cobalt (II) dinitrate, and cases in which the substance is used remain rare. No substitute has, today, been discovered, and use is strictly covered by procedures guaranteeing risk control.
EDF therefore considers that it would be particularly penalising to submit authorisation files for the little use made of the substance, if use of cobalt (II) dinitrate were to become subject to authorization.