

VIVA Research Proposal
An Investigation into the Release of Nickel Ions from Circulation Coins

This project considers the nickel release from electroplated coins and blanks produced at The Royal Mint, Llantrisant. This topic must be addressed, owing to the number of denominations in the UK that contain electroplated nickel deposits (5p, 10p & £1).

According to Lidén et al (2001 & 2008), nickel exposure is the most common cause of contact allergy in the general population, and nickel allergy is a well-known risk factor for developing hand eczema and contact dermatitis. It is not the metallic nickel that causes this, but the salts that form as a result of the reaction of the metal with sweat, which acts as a corrosive electrolyte.

EU directives are in force to regulate nickel containing products which produce significant nickel release. In 2009 the nickel directive became part of REACH Regulation Annex XVII, and stated that the regulations were for those items that were in direct and prolonged contact with the skin.

Studies have previously been carried out on European coinage, with particular focus on the one and two euro coin. Work by Nestle et al (2002) claim that the one and two euro coin exceed the acceptable value set out in the European Union directive by a factor of between 240 and 320.

Unfortunately, due to the wording of the regulations, it is difficult to apply this directly to circulation coins, as they are rarely in prolonged, direct contact with the skin.

No studies were found on UK electroplated nickel coins.

It has been decided that time dependant nickel release testing of electroplated nickel coins and blanks should be complete following BS EN 1811:2011. This is a test method using artificial sweat solution, for release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin,. This is to ensure results are comparable to other studies previously carried out on nickel containing coins.

The coins selected for testing are outlined below:

- Nickel plated blanks at each stage of minting process
- Uncirculated circulation coins
- Returned nickel plated circulated coin
- Returned Cu/Ni circulated coin

Once this testing has been complete, results will be used as a baseline. The effect of operational process parameters on nickel release then needs to be considered. Using the same test method on:

- High/ Low current density when electroplating
- High/ Low annealing temperature
- High/ Low strike force when striking

From the results of this testing, the optimum parameters for minting electroplated nickel coins, whilst minimising nickel release will be determined. These parameters should then be used as best practice when minting electroplated nickel coins.

The hypothesis from the author can be seen below:

- All coins and blanks will be above the acceptable levels set in the standard (for articles intended to come in direct and prolonged contact with the skin)
- Nickel release from electroplated nickel coins will be higher than Cu/Ni coins, owing to the 99.9% purity of the deposit

References

Lidén, C and Carter, S (2001) "Nickel release from coins", *Contact Dermatitis*, 44:3, pp. 160

Lidén, C, Skare, L and Vahter, M. (2008), "Release of nickel from coins and deposition onto skin from coin handling comparing euro coins and SEK", *Contact Dermatitis*, 59:1, pp. 31

Nestle, F, Speidel, H and Speidel, M. (2002), "High nickel release from 1- and 2-euro coins", *Nature*, 419:1, pp132

