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THE DERIVATION OF A SPECIFICATION FOR FISSION-PRODUCED MOLYBDENUM-99 FOR THE PREPARATION OF AAEC (AUTOCLAVED) MK II B ^{99}Mo/^{99m}Tc GENERATORS

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ABSTRACT

Technetium-99m eluates are shown to contain significantly lower levels of radionuclidic impurities than the parent ^{99}Mo feed solution. It is well established that alumina absorption of ^{99}Mo followed by saline elution of ^{99m}Tc leads to a considerable overall decontamination effect. This decontamination factor (DF) is defined as the ratio of radionuclidic impurities in the ^{99}Mo feed solution to radionuclidic impurities in the eluted ^{99m}Tc. Impurity measurements were made on samples of fission product ^{99m}Mo feed solutions and ^{99m}Tc eluates from nominal 20 GBq and 150 GBq AAEC (autoclaved) Mk IIB generators. Minimum DFs were obtained which were then used to derive radionuclidic purity criteria for ^{99}Mo to satisfy the requirements of the British Pharmacopoeia.

CONTENTS

1. INTRODUCTION

The AAEC manufactures sterile $^{99}Mo/^{99m}Tc$ generators using fission product ^{99}Mo from the irradiation of ^{235}U. To be a successful generator producer in a competitive market, it is essential that the generators be demonstrably reliable and able to produce ^{99m}Tc which is consistently of a high quality.

Of the many aspects of quality, probably the most important for the generator is radionuclidic purity. When ^{235}U is irradiated to produce ^{99}Mo, a range of toxic radionuclides is also produced which must be removed by radiochemical processing. The standard for processing is very high, to ensure a suitably purified ^{99}Mo product. It is a costly process in terms of both resources and time; the latter is responsible for additional losses due to radioactive decay.

Pharmacopoeic monographs specify the maximum levels of radionuclidic impurities allowed in a dose of ^{99m}Tc to be administered to a human patient. For example, the British Pharmacopoeia (BP) permits ^{99m}Tc to be contaminated at the time of injection with up to 0.1 per cent of the total activity in the ^{99}Mo. To ensure that this is complied with, the generator manufacturer must limit the alumina matrix loading to well below its maximum capacity for absorbing ^{99}Mo (maximum Mo burden < 20 per cent of the absorptive capacity of the matrix). Under these conditions, there is no movement of ^{99}Mo in the liquid phase away from the absorbed band because efficient re-absorption occurs. (Although the ^{99}Mo band may eventually be eluted from the matrix, this does not occur during the life-time of the generator.) In the case of other radionuclidic impurities the imposition of purity restrictions on the ^{99}Mo feed solution leads to enhanced quality assurance.

The radionuclidic impurities in ^{99}Mo are responsible for the contamination of ^{99m}Tc subsequently separated from the ^{99}Mo. The extent to which the individual contaminants appear in the ^{99m}Tc varies with each radionuclide. Ignoring the mechanisms by which the contaminants are transferred, measurements of relative concentrations indicate that ^{99m}Tc eluates contain significantly fewer impurities than the parent ^{99}Mo feed solution. These differences define the decontamination factor (DF):

$$DF = \frac{\text{Percentage Radionuclidic Impurities in the } ^{99}\text{Mo Feed Solution}}{\text{Percentage Radionuclidic Impurities in the Eluted } ^{99m}\text{Tc}}$$

This ratio can be measured for each likely radiocontaminant. From these values a specification can be derived which relates ^{99}Mo purity to the requirement of British Pharmacopoeia [BP 1980] for the eluates. For example, as ruthenium-103 must not exceed 0.005 per cent of the ^{99m}Tc activity and its experimentally determined DF is 100, the BP requirements will always be satisfied if the ^{103}Ru in the ^{99}Mo has a maximum concentration of $0.005 \times 100 = 0.5$ per cent. The experimental determination of the DF for each radionuclidic impurity allows the overall eluate quality for product approval to be predicted.

2. THE DETERMINATION OF DECONTAMINATION FACTORS

Decontamination factors for radionuclidic impurities which contaminate the eluates of AAEC (autoclaved) Mk IIB generators were measured on ten consecutive production batches of fission ^{99}Mo (Batch Nos. 306/4A to 307/4A inclusive). From each batch, two generators were produced to AAEC specifications [Brian, AAEC undated report] ; odd numbered generators had a nominal activity of 20 GBq and even numbered generators a nominal activity of 150 GBq. The generators were produced on Thursdays and Fridays, and their activities calibrated for the following Monday.

Each generator was eluted once daily (excluding Saturday and Sunday) for two weeks; the total time between generator manufacture and the final measurement was 17 days. For each elution, the ^{99m}Tc activity of the eluate was measured and the elution efficiency calculated. The overall performances of the generators during the first week of operation were also assessed using the performance indices method of Boyd and Hetherington [1980].

Eluates were submitted for γ-spectrometric analysis immediately after elution and again after radioactive decay for approximately 72 hours. The result from each measurement was normalised to the time of elution. The first group of measurements provided information on the short-lived impurities ^{132}I and ^{112}Ag; the measurements on the second group (3 days' decay) were used to estimate the ^{99}Mo, ^{131}I, ^{132}Te, ^{112}Pd, ^{239}Np, ^{103}Ru, ^{127}Sb, ^{95}Zr, ^{95}Nb and ^{140}Ba concentrations. Because of the very low level of impurities, the contribution by ^{99m}Tc to the γ-spectrum was reduced by shielding the samples with lead (4 mm thick initially, 2 mm thick for decayed samples).

While the purity of the daily eluates of ^{99m}Tc was being established, the radionuclidic composition of the ^{99}Mo feed solution was also being determined. Gamma spectrometric measurements were repeated daily (other than Saturday and Sunday) on the same sample of ^{99}Mo throughout the two-week period. The purpose of the time-series of re-measurements was to explore the possibility that the trace impurities become more readily detectable as the ^{99}Mo activity diminishes by decay. Often impurities not seen in the initial measurement were detected and quantified in subsequent measurements (*e.g.* ^{127}Sb, ^{95}Nb, ^{95}Zr and ^{140}Ba). However, ^{131}I could not be detected in the presence of ^{99}Mo because of a similarity in photopeak energies (^{131}I - 0.365 MeV; ^{99}Mo - 0.366 MeV). Because of this, iodine was chemically separated before being analysed by γ-spectrometry for ^{131}I, and $^{132}Te/^{132}I$.

Because of differences in the chemical form of the impurities and their half-lives in relation to that of ^{99}Mo, the concentration of radionuclide impurities in the eluted ^{99m}Tc varied with each elution. A table of half-lives is given in **appendix C**. To obtain DF values, the maximum experimental value for a selected generator was chosen as the denominator. The values of the numerator were taken, in the main, as the mean obtained from several measurements on the same sample, the exceptions being for ^{131}I and ^{132}Te concentrations, where the maximum values were used. For radionuclidic impurities with half-lives greater than that of ^{99m}Tc, the maximum concentration was recalculated to correspond to eight hours' post elution to correlate experimental results with the British Pharmacopoeia requirement in order that all concentrations refer to the time of administration, not time of elution. In the case of ^{132}I, the maximum concentration was that which occurred at the instant of elution.

The results for all generators were combined and a range of DF values was obtained for each impurity. A statement of the minimum acceptable specification for the ^{99}Mo feed solution was obtained by applying the minimum DF value. Given the relatively small number of ^{99}Mo batches used, the conservative approach was adopted. As the final product is claimed to meet BP specification, this could best be achieved by using minimum DF values.

3. SUMMARY OF RESULTS

Tables 1a and 1b compare the performance of the generators with the criteria established by Boyd and Hetherington [1980]. Results obtained from generators whose performance is poor are considered unreliable. **Table 2** summarises the radionuclidic impurities in the molybdenum-99 solutions. To obtain these results, the impurities from each batch of molybdenum-99 solution were averaged. This table is used to determine the decontamination factors for $^{132}Te/^{132}I$, ^{95}Zr, ^{95}Nb, ^{140}Ba, ^{131}I, ^{103}Ru and ^{127}Sb. **Table 3** lists the minimum decontamination factors. The results indicate that the value of the DF is influenced by the activity of the ^{99}Mo loaded on the generator. In deriving the specification for an acceptable quality of ^{99}Mo, the more conservative results were used. A full set of experimental results is given in **appendix B**.

4. DERIVATION OF THE MOLYBDENUM-99 SPECIFICATION

4.1 Introduction

In the following calculations, the minimum decontamination factors were applied to the BP specification for technetium-99m eluate to obtain a specification for the molybdenum-99 solutions of the maximum permissible concentrations of radionuclidic impurities.

4.2 Iodine-131

BP specification for ^{131}I	$= <0.005$ %
Minimum value for DF	= 0.28
Maximum conc. ^{131}I in ^{99}Mo	$= 1.4 \times 10^{-3}$ %

N.B. A DF value of <1 implies that ^{131}I in ^{99m}Tc is higher than ^{131}I in ^{99}Mo - a conclusion which is patently illogical and in disagreement with the majority of the experimental results. Iodine-131 is adsorbed as a narrow band on the alumina and is only eluted from it as a concentrated pulse after 10 or 11 elution cycles. When the ^{131}I eventually breaks through, its concentration (after correction to allow for eight hours' decay) exceeds the concentration of the ^{131}I, in the original ^{99}Mo. The specification of ^{99}Mo purity must allow for this phenomenon;

the calculation of the DF for ^{131}I must, therefore, be based upon the worst possible event during the elution history of the generator, hence the value of <1.

4.3 Ruthenium-103

BP specification for ^{103}Ru	= < 0.005 %
Minimum value for decontamination factor	= 35.9
^{103}Ru in ^{99}Mo = 35.9 × 0.005	= 0.1795 %

4.4 Tellurium-132/Iodine-132, Antimony-127, Zirconium-95, Niobium-95, and Barium-140

These impurities are frequently found in fission ^{99}Mo and, subsequently in the eluted ^{99m}Tc. The BP does not specify a maximum allowable concentration for each of these contaminants; instead it states that the total concentration of 'other γ-emitters' in ^{99m}Tc (fission) must not exceed 0.01 % of the activity attributable to ^{99m}Tc (at the time of administration), *i.e.*

$$0.01 > [(\%\ ^{132}Te/^{132}I)_{Tc} + (\%\ ^{127}Sb)_{Tc} + (\%\ ^{95}Zr)_{Tc} + (\%\ ^{95}Nb)_{Tc} + (\%^{140}Ba)_{Tc} + \text{others}\ ] \quad (1)$$

When this expression is related to the concentration of impurities in the ^{99}Mo feed solution *via* the respective minimum decontamination factors, it becomes

$$0.01 > \frac{(\%\ ^{132}Te/^{132}I)_{Mo}}{0.82} + \frac{(\%\ ^{127}Sb)_{Mo}}{6280} + \frac{(\%\ ^{95}Zr)_{Mo}}{141} + \frac{(\%\ ^{95}Nb)_{Mo}}{94} + \frac{(\%\ ^{140}Ba)_{Mo}}{45} . \quad (2)$$

A test for the suitability of the ^{99}Mo would ensue from the application of this expression to the results of γ-spectrometric analysis. In practice, this is difficult for, in the data, some of the radionuclidic impurities are masked by the other radionuclides and cannot be detected until the sample is three to four days old. Hence, if the determination of suitability is to be completed before commencing generator production, it is necessary to resort to an alternative test which accepts much less comprehensive input data.

Since the differences in the ranges, means and standard deviations of the respective concentrations of ^{132}Te, ^{95}Zr, ^{95}Nb and ^{140}Ba as listed in **table 2** are quite small, an accurate measurement of one impurity might be taken as an approximate determination for each impurity. Such an assumption does not introduce the possibility of gross error because, with the exception of $^{132}Te/^{132}I$, the radionuclidic impurities included in this group each exhibit a large decontamination factor.

If the $^{132}Te/^{132}I$ concentration is accurately known and the same results is then assigned also to ^{95}Zr, ^{95}Nb and ^{140}Ba, **equation 2** can be rewritten as

$$0.01 = (\%\ ^{132}Te/^{132}I)_{Mo} \left(\frac{1}{0.82} + \frac{1}{141} + \frac{1}{94} + \frac{1}{45}\right) + \frac{(\%^{127}Sb)_{Mo}}{6280}$$

$$0.01 = 1.259(\%\ ^{132}Tc/^{132}I)_{Mo} + \frac{(\%\ ^{127}Sb)_{Mo}}{6280} .$$

This expression can be solved for $(\%\ ^{132}Te/^{132}I)_{Mo}$ *only if* the contribution due to ^{127}Sb can be ignored (because of the very large value of the DF for ^{127}Sb) or be assigned an arbitrary value. Since it is preferable to be conservative when developing a specification, a value is assigned to $(\%\ ^{127}Sb\ )_{Mo}$ equal to the highest value recorded in the experimental measurements (0.177 %) plus three standard deviations on the mean value (3 × 0.058 = 0.174%). For the limiting case, equation 2 then reduces to

$$0.01 = 1.259\,(\%\ ^{132}Te/^{132}I)_{Mo} + 0.00006$$

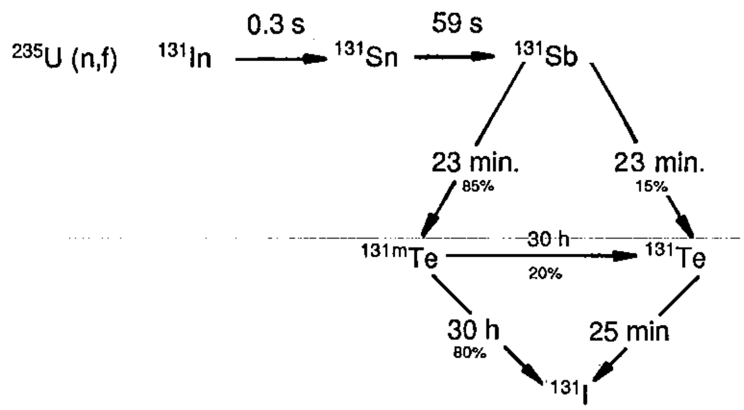
or

$$\%(^{132}Te/^{132}I)_{Mo} = 0.008\%$$

(It follows that this value applies also to ^{95}Nb, ^{95}Zr and ^{140}Ba.)

4.5 Special Conditions Applying to Iodine-131

The formation of ^{131}I from ^{235}U by fission follows a complex decay pathway:



The branching of the fission product decay series implies that ^{131}I continues to form several days after the end of neutron activation. Hence an early measurement of $(\%\ ^{131}I)_{Mo}$ could be an underestimate. In practice, the extent of the error was demonstrated to be up to a factor of two.

The need for a conservative approach in the derivation of the specification requires that a safety factor of two be applied to compensate for the risk that further ^{131}I is formed from the delayed decay of thirty-hour ^{131m}Te. Hence the derived maximum level of $(\%\ ^{131}I)_{Mo}$ of 1.4×10^{-3} must be modified to 0.7×10^{-3}.

4.6 Molybdenum-99 Specification for the AAEC Autoclaved Generators.

In the light of the foregoing comments, it is proposed that the minimum acceptable quality for the ^{99}Mo feed solution guaranteed to produce ^{99m}Tc eluates which will satisfy the BP requirements of radionuclidic purity, up to 8 hours after elution, is as follows:

$^{131}I < 7 \times 10^{-4}$ %,

$^{103}Ru < 0.18$ %,

$^{132}Te/^{132}I$, ^{95}Zr, ^{95}Nb and ^{140}Ba, each < 0.008 %,

$^{127}Sb < 0.35$ %.

5. DEMONSTRATION OF THE EFFECTIVENESS OF THE SPECIFICATION

By applying the specification derived in **section 4.6** for the molybdenum-99 feed solutions, the batches fail according to **table 4**. Of the twenty generators made from these batches, only three (Nos. 9, 19 and 20) produced eluates which did not comply with the BP requirements. Although this suggests that the specification may be too harsh, it should be remembered that the results were obtained by eluting the generators every 24-hours. If elutions were performed more frequently, then all the impurity levels would be elevated. For example, if a generator is eluted two hours after the previous elution (which may occur if insufficient technetium-99m is obtained at the first elution, it is necessary to assume that the ^{99m}Tc and ^{132}I have grown, respectively, to only approximately 25 and 60 per cent of the 24-hour activity, and that the concentration of all the other impurities is volume-dependent and hence unaffected by the short inter-elution period.

Under these conditions, 13 of the 20 AAEC generators do not meet BP specifications, a fact which lowers their competitiveness. If no restriction is to be placed on the frequency of elution of generators, the conservative approach of using minimum DFs to determine the specification for the molybdenum-99 is mandatory to ensure that BP requirements for the eluates are met in all instances.

6. CONCLUSIONS

A specification for the radionuclidic purity of fission product ^{99}Mo has been derived on the basis of experimentally determined decontamination factors. If the batch of ^{99}Mo passes this test, the ^{99m}Tc produced from it will also always pass the BP requirement. If the ^{99}Mo does not satisfy the specification, the ^{99m}Tc will sometimes fail the test. Since, in practice, quality control criteria must always be conservative, this approach appears to be justified.

7. REFERENCES

British Pharmacopoeia [1980] - Monograph on Sodium Pertechnetate (^{99m}Tc) Injection (fission), p.896.

Brian, H.H. [undated] - AAEC master manufacturing specifications for Mk IIB autoclaved generators. AAEC unpublished report.

Boyd R.E., Hetherington E.L.R. [1980] - Technetium-99m generators - operational assessment by performance indices. *Int. J. Appl. Radiat. Isot.*, 31 : 250-253.

TABLE 1
GENERATOR PERFORMANCE INDICES (1ST WEEK OF OPERATION)

TABLE 1a
NOMINAL 20 GBq ^{99}Mo GENERATORS

Generator Number	Generator Activity (GBq)	^{99}Mo Batch No	Index No. 1	Index No. 2
1	22.4	306/4A	Pass	4th Class
3	22.3	306/4B	Pass	4th Class
5	23.0	306/4C	Pass	4th Class
7	26.0	307/1A	Fail	4th Class
9	28.0	307/1B	Pass	4th Class
11	27.9	307/2A	Pass	4th Class
13	22.4	307/2B	Pass	4th Class
15	23.0	307/3A	Fail	4th Class
17	22.0	307/3B	Pass	3rd Class
19	23.0	307/4A	Pass	2nd Class

TABLE 1b
NOMINAL 20 GBq ^{99}Mo GENERATORS

Generator Number	Generator Activity (GBq)	^{99}Mo Batch No	Index No. 1	Index No. 2
2	150	306/4A	Pass	1st Class
4	162	306/4B	Pass	1st Class
6	163	306/4C	Pass	1st Class
8	177	307/1A	Pass	1st Class
10	172	307/1B	Pass	1st Class
12	163.9	307/2A	Pass	1st Class
14	164.5	307/2B	Pass	1st Class
16	138.0	307/3A	Pass	2nd Class
18	164.0	307/3B	Pass	1st Class
20	160.0	307/4A	Pass	1st Class

Index No. 1 ; Pass = Values of elution efficiency within ±5 % of a normalised mean value.
Fail = Values of elution efficiency outside ±5 % of a normalised mean value.

Index No. 2 ; 1st class = <2 per cent loss of efficiency/elution; 2nd Class = <3 % loss of efficiency/elution;
3rd Class = <4 % loss efficiency/elution; 4th Class = >4 % loss of efficiency/elution.

TABLE 2
RADIONUCLIDIC IMPURITIES IN ^{99}Mo

Radioisotope	Range	Mean × 10^{-3}	s.d.
$^{132}Te/^{132}I$	2.8×10^{-3} - 1.7×10^{-2}	7.3×10^{-3}	4.7×10^{-3}
^{95}Zr	n.d. - 2.1×10^{-2}	5.7×10^{-3}	7.3×10^{-3}
^{95}Nb	n.d. - 9.4×10^{-3}	3.0×10^{-3}	3.6×10^{-3}
^{140}Ba	n.d. - 2.1×10^{-2}	5.9×10^{-3}	2.4×10^{-3}
^{131}I	5.0×10^{-4} - 1.3×10^{-2}	2.3×10^{-3}	3.6×10^{-3}
^{103}Ru	0.023 - 0.227	0.076×10^{3}	0.061
^{127}Sb	n.d. - 0.177	0.106×10^{3}	0.058

n.d. not detected. s.d. standard deviation.

TABLE 3
MINIMUM DECONTAMINATION FACTORS

Radionculide	Generator Activity	Minimum Decontamination Factor
^{131}I	150	0.28
	20	0.38
^{103}Ru	150	72
	20	35.9
$^{132}Te/^{132}I$	150	3.2
	20	0.82
^{127}Sb	150	6 280
	20	13 600
^{95}Zr	150	732
	20	141
^{95}Nb	150	732
	20	94
^{140}Ba	150	45
	20	n.d.

TABLE 4
IMPURITIES WHICH FAILED SPECIFICATION

^{99}Mo Batch	Radionuclide(s)
306-4A	^{131}I
306-4B	^{131}I
306-4C	^{131}I
307-1A	^{131}I
307-1B	^{131}I, ^{103}Ru, ^{132}I, ^{140}Ba
307-2A	^{131}I, ^{132}I, ^{140}Ba
307-2B	^{132}I
307-3A	^{131}I, ^{132}I
307-3B	^{131}I, ^{95}Zr
307-4A	^{131}I, ^{95}Zr

TABLE 5
PREDICTABLE RADIONUCLIDIC IMPURITIES IN EXCESS OF THOSE PERMITTED BY BP

Generator Number	^{99}Mo Batch No.	Radionuclide(s)
1	306/4A	Nil
2		Nil
3	306/4B	^{131}I; ^{103}Ru
4		^{131}I
5	306/4C	^{131}I
6		^{131}I
7	307/1A	Nil
8		Nil
9	307/1B	^{131}I; ^{132}I
10		^{131}I; ^{132}I
11	307/2A	^{132}I
12		Nil
13	307/2B	^{132}I
14		^{132}I
15	307/3A	^{132}I; ^{103}Ru
16		^{131}I
17	307/3B	Nil
18		Nil
19	307/4A	^{131}I
20		^{131}I

APPENDIX A

DETERMINATION OF THE ^{131}I CONTENT OF FISSION PRODUCT MOLYBDENUM-99

A1. GENERAL INTRODUCTION

The identification of ^{131}I in ^{99}Mo by gamma spectrometry is difficult because the most abundant photopeak of ^{131}I (0.365 MeV) is masked by the 0.366 MeV peak of ^{99}Mo. This problem can be overcome by utilising the second most abundant peak of ^{131}I (0.637 MeV), where interference from the ^{99}Mo peak is negligible. However, this could lead to a marked loss in sensitivity because emissions at 0.637 MeV have an abundance of 9.3 per cent whereas those at 0.365 MeV have an abundance of 79 per cent. Since the determination of trace quantities of ^{131}I in the presence of a vast excess of ^{99}Mo gamma spectrometry will not produce the desired result, ^{131}I must be separated before quantification.

A number of methods have been developed to determine fission product radioiodine activities; these normally involve the use of carrier iodide in which oxidation-reduction reactions in acid solution produce I_2 which is then extracted into a solvent such as chloroform or carbon tetrachloride. Low and erratic yields occur owing to the incomplete interchange between the radioiodine and the carrier.

To be applied as a routine test for the determination of ^{131}I given a highly radioactive solution of ^{99}Mo, the method must not only be sensitive, but also fast enough to minimise the dose to the analyst. At Lucas Heights, the latter requirements have precluded the use of multi-stage solvent extraction techniques. Instead, a method was developed which is not only accurate and reproducible but is both simple to operate and safe. It involves the reaction of iodide and iodate in acid medium to form elemental iodine:

$$5I^- + IO_3^- + 6H^+ = 3I_2 + 3H_2O.$$

To ensure complete reaction in the ^{99}Mo solution, iodide and iodate carriers are added in the appropriate molar ratio. The iodide is separated by sublimation from the acid solution and then absorbed in an alkali trap. The process occurs rapidly, with a high iodine recovery and incurs a very low contamination with ^{99}Mo. Simple γ-spectrometry of the distillate provides information on the ^{131}I, ^{132}I (hence ^{132}Te) and ^{133}I concentrations in the ^{99}Mo feed solution.

A2. METHOD OF DETERMINATION

A2.1 Apparatus

A 25 mL micro-still is connected *via* an air condenser to a caustic soda bubbler (2 mL); the still is heated by a small electric mantle and a continuous sparge of air is supplied to the still by an aquarium aerator.

A2.2 Reagents

6 <u>N</u> NaOH; KI solution (10 mg (I) mL^{-1}); KIO_3 solution (10 mg (IO_3^-) mL^{-1}) ; ammonium molybdate solution (100 µg Mo mL^{-1}); 1 <u>M</u> HNO_3.

A2.3 Procedure

Add two drops of NaOH to the still and then mix 1 mL of sample (50-100 MBq ^{99}Mo), 1 mL KI solution, 0.3 mL KIO_3 solution and 1 mL ammonium molybdate solution with air bubbles. Add 1.5 mL NaOH to the trap. Quickly add to the still sufficient HNO_3 (1-2 mL) to promote the reaction leading to the formation of elemental iodine; seal the still and commence heating gently. Iodine needles collect in the air condenser as a band approximately 1 cm long. As the heating progresses, the band gradually moves along the condenser until it enters the NaOH and is dissolved.

After approximately 20 minutes, the sublimation of iodine is complete; this can be assessed visually by the disappearance of colour from the liquor in the still and the fact that no more needle-crystals are formed in the still head and condenser. The NaOH trap is then emptied and washed repeatedly with water; the alkaline-iodide solution plus the washings are placed in a thin-walled counting vial, the volume adjusted to 10 mL and the vial sealed. The vial is placed in a lead pot (2 mm wall thickness) and the sample examined by gamma spectrometry to estimate the ^{131}I, ^{132}I and ^{133}I content. Separation and measurement of the radioiodines is done in duplicate.

APPENDIX B
EXPERIMENTAL RESULTS

TABLE B1
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-4A

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
30.09.83	30.09.83	100	-	n.d.	-	n.d.	n.d.	n.d.	n.d.
04.10.83	30.09.83	99.917	-	0.0288	-	0.0413	3.34×10^{-3} ^{140}Ba	n.d.	n.d.
05.10.83	30.09.83	100	-	n.d.	-	n.d.	n.d.	n.d.	n.d.
06.10.83	30.09.83	100	-	n.d.	-	n.d.	n.d.	n.d.	n.d.
07.10.83	30.09.83	99.976	-	0.0236	-	n.d.	n.d.	n.d.	n.d.
10.10.83	30.09.83	99.964	-	0.0360	-	n.d.	n.d.	n.d.	n.d.
11.10.83	30.09.83	99.962	-	0.0383	-	n.d.	n.d.	n.d.	n.d.
12.10.83	30.09.83	99.957	1.1×10^{-3}	0.0435	2.8×10^{-3}	n.d.	n.d.	n.d.	n.d.
13.10.83	30.09.83	99.967	-	0.0325	-	n.d.	n.d.	n.d.	n.d.
14.10.83	30.09.83	99.972	-	0.0278	-	n.d.	n.d.	n.d.	n.d.
17.10.83	30.09.83	99.967	-	0.0326	-	n.d.	n.d.	n.d.	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.1×10^{-3}	0.0329	2.8×10^{-3}	0.0413	$^{140}Ba/^{140}La$ 3.4×10^{3}	-	-

n.d. not detected

TABLE B2
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 306-4B

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
30.09.83	30.09.83	99.912	-	0.088	-	n.d.	n.d.	n.d.	n.d.
04.10.83	30.09.83	99.732	-	0.0882	-	0.168	3.0×10^{-3} ^{140}Ba	n.d.	n.d.
05.10.83	30.09.83	99.724	-	0.101	-	0.152	3.0×10^{-3} ^{140}Ba	n.d.	n.d.
06.10.83	30.09.83	99.884	-	0.0885	-	n.d.	3.5×10^{3} ^{140}Ba	n.d.	n.d.
07.10.83	30.09.83	99.737	-	0.0846	-	0.130	4.0×10^{-3} ^{140}Ba	n.d.	n.d.
10.10.83	30.09.83	99.621	-	0.0840	-	0.158	3.7×10^{-3} ^{140}Ba	n.d.	n.d.
11.10.83	30.09.83	99.797	-	0.0918	-	0.111	n.d.	n.d.	n.d.
12.10.83	30.09.83	99.738	-	0.0970	-	0.165	n.d.	n.d.	n.d.
13.10.83	30.09.83	99.742	-	0.0895	-	0.168	n.d.	n.d.	n.d.
14.10.83	30.09.83	99.912	1.5×10^{-3}	0.0879	6.6×10^{-3}	n.d.	n.d.	n.d.	n.d.
17.10.83	30.09.83	99.914	-	0.0862	-	n.d.	n.d.	n.d.	n.d.
							n.d.	n.d.	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.5×10^{-3}	0.0897	6.6×10-$^{-3}$	0.150	3.6×10^{3} ^{140}Ba	-	-

n.d. not detected.

TABLE B3
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 306-4C

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
30.09.83	30.09.83	99.804	-	0.0413	-	0.154	n.d.	n.d.	n.d.
04.10.83	30.09.83	99.786	-	0.0583	-	0.151	5.0×10^{-3} ^{140}Ba	n.d.	n.d.
05.10.83	30.09.83	99.778	-	0.0515	-	0.166	4.5×10^{-3} ^{140}Ba	n.d.	n.d.
06.10.83	30.09.83	99.794	-	0.0528	-	0.150	3.5×10^{-3} ^{140}Ba	n.d.	n.d.
07.10.83	30.09.83	99.729	-	0.0574	-	0.216	n.d.	n.d.	n.d.
10.10.83	30.09.83	99.765	-	0.0556	-	0.180	n.d.	n.d.	n.d.
11.10.83	30.09.83	99.747	-	0.0571	-	0.196	n.d.	n.d.	n.d.
12.10.83	30.09.83	99.777	-	0.0520	-	0.165	6.4×10^{-3} ^{140}Ba	n.d.	n.d.
13.10.83	30.09.83	99.757	-	0.0583	-	0.180	4.8×10^{-3} ^{140}Ba	n.d.	n.d.
14.10.83	30.09.83	99.755	-	0.0535	-	0.192	n.d.	n.d.	n.d.
17.10.83	30.09.83	99.746	1.6×10^{-3}	0.0606	4.8×10^{-3}	0.194	n.d.	n.d.	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.6×10^{-3}	0.0544	4.8×10^{-3}	0.177	4.8×10^{-3} ^{140}Ba	-	-

n.d. not detected.

TABLE B4
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-1A

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
07.10.83	07.10.83	99.970	-	0.0300	-	n.d.	n.d.	n.d.	n.d.
10.10.83	07.10.83	100	-	n.d.	-	n.d.	n.d.	n.d.	n.d.
11.10.83	07.10.83	99.981	-	0.0195	-	n.d.	n.d.	n.d.	n.d.
12.10.83	07.10.83	99.981	-	0.0189	-	n.d.	n.d.	n.d.	n.d.
13.10.83	07.10.83	99.967	-	0.0327	-	n.d.	n.d.	n.d.	n.d.
14.10.83	07.10.83	100	-	n.d.	-	n.d.	n.d.	n.d.	n.d.
17.10.83	07.10.83	99.985	-	0.0148	-	n.d.	n.d.	n.d.	n.d.
18.10.83	07.10.83	99.986	9.6×10^{-4}	0.0143	1.2×10^{-3}	n.d.	n.d.	n.d.	n.d.
19.10.83	07.10.83	99.982	-	0.0178	-	n.d.	n.d.	n.d.	n.d.
20.10.83	07.10.83	99.968	-	0.0320	-	n.d.	n.d.	n.d.	n.d.
21.10.83	07.10.83	99.975	-	0.0253	-	n.d.	n.d.	n.d.	n.d.
24.10.83	07.10.83	99.975	-	0.0251	-	n.d.	n.d.	n.d.	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			9.6×10^{-4}	0.023	1.2×10^{-3}	n.d.	n.d.	n.d.	n.d.

n.d. not detected.

TABLE B5
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-1B

Measurement Date	Reference Date	Percentage of the Total Activity							
		^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
07.10.83	07.10.83	99.740	-	0.150	0.0376	0.0900	n.d.	n.d.	2.0×10^{-2} ^{140}Ba
10.10.83	07.10.83	99.510	-	0.225	0.0272	0.175	n.d.	n.d..	2.1×10^{-2} ^{140}Ba
11.10.83	07.10.83	99.565	-	0.248	0.0365	0.144	0.006 ^{95}Zr	n.d.	n.d.
12.10.83	07.10.83	99.565	-	0.248	0.0365	0.144	0.006 ^{95}Zr	n.d.	n.d.
13.10.83	07.10.83	99.570	-	0.216	0.0508	0.163	n.d.	n.d.	n.d.
14.10.83	07.10.83	99.582	-	0.248	0.0480	0.122	n.d.	n.d.	n.d.
17.10.83	07.10.83	99.566	-	0.230	0.0315	9.143	0.010 ^{95}Zr	n.d.	1.9×10^{-2} ^{140}Ba
~~18.10.83~~	~~07.10.83~~	~~99.618~~	~~-~~	~~0.232~~	~~n.d.~~	~~0.139~~	~~0.010 ^{95}Zr~~	~~n.d.~~	~~n.d.~~
19.10.83	07.10.83	99.583	9.4×10^{-4}	0.220	3.0×10^{-2}	0.149	0.006 ^{95}Zr	n.d.	n.d.
20.10.83	07.10.83	99.555	-	0.242	n.d.	0.166	0.010 ^{95}Zr	n.d.	2.3×10^{-2} ^{140}Ba
21.10.83	07.10.83	99.553	-	0.236	0.0658	0.136	0.009 ^{95}Zr	n.d.	n.d.
24.10.83	07.10.83	99.626	-	0.223	n.d.	0.118	0.008 ^{95}Zr	0.003 ^{95}Nb	2.3×10^{-2} ^{140}Ba
Impurity Concentration used in the Calculation of Decontamination Factor.			9.4×10^{-4}	0.227	0.0404	0.141	0.008 ^{95}Zr	0.003 ^{95}Nb	0.021 ^{140}Ba

n.d. not detected.

TABLE B6
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-2A

Measurement Date	Reference Date	Percentage of the Total Activity							
		^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
13.10.83	13.10.83	99.835	7.5×10^{-4}	0.0508	7.4×10^{-3}	0.114	n.d.	n.d.	n.d.
17.10.83	13.10.83	99.895	-	0.0175	n.d.	0.087	n.d.	n.d.	n.d.
18.10.83	13.10.83	99.743	-	0.0824	0.0179	0.156	n.d.	n.d.	n.d.
19.10.83	13.10.83	99.817	1.4×10^{-3}	0.0862	1.5×10^{-2}	0.097	n.d.	n.d.	0.0134 ^{140}Ba
20.10.83	13.10.83	99.768	-	0.0844	0.0183	0.116	n.d.	n.d.	0.0134 ^{140}Ba
21.10.83	13.10.83	99.771	-	0.0836	n.d.	0.132	n.d.	n.d.	0.0128 ^{140}Ba
24.10.83	13.10.83	99.710	-	0.0778	n.d.	0.199	n.d.	n.d.	n.d.
25.10.83	13.10.83	99.913	-	0.0835	n.d.	n.d.	n.d.	0.0031 ^{95}Nb	0.0142 ^{140}Ba
26.10.83	13.10.83	99.772	-	0.0719	n.d.	0.142	n.d.	n.d.	n.d.
27.10.83	13.10.83	99.711	-	0.0826	n.d.	0.199	0.0068 ^{95}Zr	n.d.	n.d.
28.10.83	13.10.83	99.699	-	0.0810	n.d.	0.216	0.0042 ^{95}Zr	n.d.	n.d.
31.10.83	13.10.83	99.733	-	0.0809	n.d.	0.176	0.0070 ^{95}Zr	0.0032 ^{95}Nb	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.4×10^{-3}	0.0736	0.0171	0.149	0.0060 ^{95}Zr	0.0032 ^{95}Nb	0.0135 ^{140}Ba

n.d. not detected.

TABLE B7
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-2B

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
14.10.83	14.10.83	99.859	5×10^{-4}	0.0160	6×10^{-3}	0.125	n.d.	n.d.	n.d.
17.10.83	14.10.83	99.794	-	0.0612	-	0.145	n.d.	n.d.	n.d.
18.10.83	14.10.83	99.835	-	0.0433	-	0.122	n.d.	n.d.	n.d.
19.10.83	14.10.83	99.806	4.8×10^{-4}	0.0372	1.0×10^{-2}	0.157	n.d.	n.d.	n.d.
20.10.83	14.10.83	99.826	-	0.0420	-	0.126	n.d.	n.d.	0.0062 ^{140}Ba
21.10.83	14.10.83	99.793	-	0.0679	-	0.134	n.d.	n.d.	0.0048 ^{140}Ba
24.10.83	14.10.83	99.758	-	0.0499	-	0.192	n.d.	n.d.	n.d.
25.10.83	14.10.83	99.724	-	0.0493	-	0.227	n.d.	n.d.	n.d.
26.10.83	14.10.83	99.770	-	0.0637	-	0.167	n.d.	n.d.	n.d.
27.10.83	14.10.83	99.767	-	0.0565	-	0.176	n.d.	n.d.	n.d.
28.10.83	14.10.83	99.949	-	0.0513	-	n.d.	n.d.	n.d.	n.d.
31.10.83	14.10.83	99.951	-	0.0489	-	n.d.	n.d.	n.d.	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			5.0×10^{-4}	0.0489	1.0×10^{-2}	0.157	n.d.	n.d.	0.0055 ^{140}Ba

n.d. not detected.

TABLE B8
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-3A

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
21.10.83	21.10.83	99.847	7.8×10^{-4}	0.0671	7.5×10^{-3}	0.0858	n.d.	n.d.	n.d.
24.10.83	21.10.83	99.864	-	0.0905	-	0.0451	n.d.	n.d.	n.d.
25.10.83	21.10.83	99.740	1.1×10^{-3}	0.0993	1.2×10^{-2}	0.127	n.d.	n.d.	n.d.
26.10.83	21.10.83	99.892	-	0.108	-	n.d.	n.d.	n.d.	n.d.
27.10.83	21.10.83	99.902	-	0.0977	-	n.d.	n.d.	n.d.	n.d.
28.10.83	21.10.83	99.814	-	0.0992	-	0.0826	0.0041 ^{95}Zr	n.d.	n.d.
31.10.83	21.10.83	99.858	-	0.142	-	n.d.	n.d.	n.d.	n.d.
01.11.83	21.10.83	99.855	-	0.145	-	n.d.	n.d.	n.d.	n.d.
02.10.83	21.10.83	99.868	-	0.128	-	n.d.	n.d.	0.0042 ^{95}Nb	n.d.
03.11.83	21.10.83	99.696	-	0.160	-	0.128	0.0092 ^{95}Zr	0.0063 ^{95}Nb	n.d.
04.10.83	21.10.83	99.809	-	0.173	-	n.d.	0.0126 ^{95}Zr	0.0061 ^{95}Nb	n.d.
07.11.83	21.10.83	99.832	-	0.154	-	n.d.	0.0068 ^{95}Zr	0.0064 ^{95}Nb	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.1×10^{-3}	0.122	1.2×10^{-2}	0.094	0.0082 ^{95}Zr	0.0058 ^{95}Nb	-

n.d. not detected.

TABLE B9
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-3B

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
21.10.83	21.10.83	99.962	1.3×10^{-3}	n.d.	6.2×10^{-3}	0.0299	n.d.	n.d.	0.0079 ^{140}Ba
24.10.83	21.10.83	99.985	-	0.0149	-	n.d.	n.d.	n.d.	n.d.
25.10.83	21.10.83	99.911	6.8×10^{-4}	0.0244	5.3×10^{-3}	0.0412	0.0236 ^{95}Zr	n.d.	n.d.
26.10.83	21.10.83	99.965	-	0.0233	-	n.d.	0.0117 ^{95}Zr	n.d.	n.d.
27.10.83	21.10.83	99.871	-	0.0247	-	0.0944	0.0096 ^{95}Zr	n.d.	n.d.
28.10.83	21.10.83	99.901	-	0.0279	-	0.0643	0.0070 ^{95}Zr	n.d.	n.d.
31.10.83	21.10.83	99.957	-	0.0236	-	n.d.	0.0136 ^{95}Zr	0.0056 ^{95}Nb	n.d.
01.11.83	21.10.83	99.942	-	0.0339	-	n.d.	0.0126 ^{95}Zr	0.0062 ^{95}Nb	0.0058 ^{140}Ba
02.11.83	21.10.83	99.954	-	0.0273	-	n.d.	0.0124 ^{95}Zr	0.0060 ^{95}Nb	n.d.
03.11.83	21.10.83	99.930	-	0.0382	-	n.d.	0.0174 ^{95}Zr	0.0090 ^{95}Nb	0.0060 ^{140}Ba
04.11.83	21.10.83	99.942	-	0.0467	-	n.d.	n.d.	0.0108 ^{95}Nb	n.d.
07.11.83	21.10.83	99.934	-	0.0330	-	n.d.	0.0152 ^{95}Zr	0.0108 ^{95}Nb	0.0068 ^{140}Ba
Impurity Concentration used in the Calculation of Decontamination Factor			1.3×10^{-3}	0.0289	6.2×10^{-3}	0.0575	0.0137 ^{95}Zr	0.0081 ^{95}Nb	0.0066 ^{140}Ba

n.d. not detected.

TABLE B10
RADIONUCLIDIC PURITY ANALYSIS OF PRODUCTION BATCHES OF f.p. ^{99}Mo
BATCH NO. 307-4A

		Percentage of the Total Activity							
Measurement Date	Reference Date	^{99}Mo	^{131}I	^{103}Ru	^{132}Te	^{132}I	^{127}Sb A	Impurity B	Impurity C
28.10.83	28.10.83	99.896	6.0×10^{-3}	0.0248	6.0×10^{-3}	0.0795	n.d.	n.d.	n.d.
31.11.83	28.10.83	99.936	1.3×10^{-2}	0.0642	8.5×10^{-3}	n.d.	n.d.	n.d.	n.d.
01.11.83	28.10.83	99.884	-	0.0587	-	0.0567	n.d.	n.d.	n.d.
02.11.83	28.10.83	99.789	-	0.0674	-	0.124	0.0129 ^{95}Zr	n.d.	0.0068 ^{140}Ba
03.11.83	28.10.83	99.817	-	0.0540	-	0.106	0.0229 ^{95}Zr	n.d.	n.d.
04.11.83	28.10.83	99.915	-	0.0604	-	n.d.	0.0160 ^{95}Zr	0.0079 ^{95}Nb	n.d.
07.11.83	28.10.83	99.817	-	0.0573	-	0.102	0.0185 ^{95}Zr	0.0050 95Nb	n.d.
08.11.83	28.10.83	99.896	-	0.0607	-	n.d.	0.0264 ^{95}Zr	0.0071 ^{95}Nb	0.0093 ^{140}Ba
09.11.83	28.10.83	99.916	-	0.0593	-	n.d.	0.0160 ^{95}Zr	0.0072 ^{95}Nb	n.d.
10.11.83	28.10.83	99.907	-	0.0718	-	n.d.	0.0151 ^{95}Zr	0.0062 ^{95}Nb	n.d.
11.11.83	28.10.83	99.915	-	0.0558	-	n.d.	0.0171 ^{95}Zr	0.0064 ^{95}Nb	0.0061 ^{140}Ba
14.11.83	28.10.83	99.907	-	0.0626	-	n.d.	0.0211 ^{95}Zr	0.0094 ^{95}Nb	n.d.
Impurity Concentration used in the Calculation of Decontamination Factor			1.3×10^{-2}	0.0581	8.5×10^{-3}	0.0936	0.0183 ^{95}Zr	0.00703 ^{95}Nb	0.0074 ^{140}Ba

n.d. not detected.

TABLE B11
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 306-4A

(a) Generator No. 1

Activity 22.4 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	98.18
2	05.10.83	90.63
3	06.10.83	81.42
4	07.10.83	77.07
5	10.10.83	77.59
6	11.10.83	83.48
7	12.10.83	77.33
8	13.10.83	79.57
9	14.10.83	91.74
10	17.10.83	88.05

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 2

Activity 150 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	94.51
2	05.10.83	94.53
3	06.10.83	94.47
4	07.10.83	93.78
5	10.10.83	95.54
6	11.10.83	93.50
7	12.10.83	88.73
8	13.10.83	87.05
9	14.10.83	82.07
10	17.10.83	85.50

Index No.1 Pass *Index No.2* 1st Class

TABLE B12
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 306-4B

(a) Generator No. 3

Activity 22.3 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	96.93
2	05.10.83	84.11
3	06.10.83	70.86
4	07.10.83	64.95
5	10.10.83	64.75
6	11.10.83	80.63
7	12.10.83	79.56
8	13.10.83	81.07
9	14.10.83	91.95
10	17.10.83	84.93

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 4

Activity 162 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	97.08
2	05.10.83	96.76
3	06.10.83	95.70
4	07.10.83	95.59
5	10.10.83	92.82
6	11.10.83	95.55
7	12.10.83	94.13
8	13.10.83	92.30
9	14.10.83	94.75
10	17.10.83	91.31

Index No.1 Pass *Index No.2* 1st Class

TABLE B13
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 306-4C

(a) Generator No. 5

Activity 23 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	97.72
2	05.10.83	92.52
3	06.10.83	82.41
4	07.10.83	74.96
5	10.10.83	79.36
6	11.10.83	81.50
7	12.10.83	80.32
8	13.10.83	83.46
9	14.10.83	85.69
10	17.10.83	88.00

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 6

Activity 163 GBq *Calibration Date* 3.10.83

Eluate No.	Elution Date	Elution Efficiency
1	04.10.83	95.40
2	05.10.83	94.26
3	06.10.83	93.63
4	07.10.83	93.04
5	10.10.83	94.29
6	11.10.83	95.70
7	12.10.83	93.05
8	13.10.83	93.28
9	14.10.83	92.11
10	17.10.83	90.22

Index No.1 Pass *Index No.2* 1st Class

TABLE B14
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-1A

(a) Generator No. 7

Activity 26 GBq *Calibration Date* 10.10.83

Eluate No.	Elution Date	Elution Efficiency
1	10.10.83	90.08
2	11.10.83	72.91
3	12.10.83	55.76
4	13.10.83	58.85
5	14.10.83	93.58
6	16.10.83	92.41
7	18.10.83	95.87
8	19.10.83	79.60
9	20.10.83	93.99
10	21.10.83	87.08
11	24.10.83	93.62

Index No.1 Fail *Index No.2* 4th Class

(b) Generator No. 8

Activity 177 GBq *Calibration Date* 10.10.83

Eluate No.	Elution Date	Elution Efficiency
1	10.10.83	89.54
2	11.10.83	92.03
3	12.10.83	93.73
4	13.10.83	95.20
5	14.10.83	96.30
6	16.10.83	93.43
7	18.10.83	97.79
8	19.10.83	93.04
9	20.10.83	93.14
10	21.10.83	92.28
11	24.10.83	92.52

Index No.1 Pass *Index No.2* 1st Class

TABLE B15
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-1B

(a) Generator No. 9

Activity 28 GBq *Calibration Date* 10.10.83

Eluate No.	Elution Date	Elution Efficiency
1	10.10.83	92.95
2	11.10.83	92.06
3	12.10.83	89.33
4	13.10.83	78.61
5	14.10.83	76.37
6	16.10.83	71.35
7	18.10.83	74.15
8	19.10.83	79.28
9	20.10.83	79.18
10	21.10.83	83.03
11	24.10.83	89.05

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 10

Activity 172 GBq *Calibration Date* 10.10.83

Eluate No.	Elution Date	Elution Efficiency
1	10.10.83	94.25
2	11.10.83	89.92
3	12.10.83	89.33
4	13.10.83	88.96
5	14.10.83	90.31
6	16.10.83	88.61
7	18.10.83	89.05
8	19.10.83	71.96
9	20.10.83	68.43
10	21.10.83	68.30
11	24.10.83	71.90

Index No.1 Pass *Index No.2* 1st Class

TABLE B16
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-2A

(a) Generator No. 11

Activity 27.9 GBq *Calibration Date* 17.10.83

Eluate No.	Elution Date	Elution Efficiency
1	17.10.83	95.78
2	18.10.83	97.30
3	19.10.83	91.43
4	20.10.83	86.03
5	21.10.83	79.74
6	24.10.83	83.83
7	25.10.83	79.88
8	26.10.83	80.89
9	27.10.83	82.38
10	28.10.83	85.98
11	31.10.83	87.04

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 12

Activity 163.9 GBq *Calibration Date* 17.10.83

Eluate No.	Elution Date	Elution Efficiency
1	17.10.83	93.22
2	18.10.83	96.22
3	19.10.83	94.59
4	20.10.83	94.01
5	21.10.83	93.10
6	24.10.83	94.64
7	25.10.83	95.64
8	26.10.83	94.36
9	27.10.83	92.84
10	28.10.83	94.21
11	31.10.83	94.74

Index No.1 Pass *Index No.2* 1st Class

TABLE B17
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-2B

(a) Generator No. 13

Activity 22.4 GBq *Calibration Date* 17.10.83

Eluate No.	Elution Date	Elution Efficiency
1	17.10.83	95.75
2	18.10.83	95.94
3	19.10.83	87.06
4	20.10.83	82.12
5	21.10.83	75.18
6	24.10.83	82.49
7	25.10.83	78.77
8	26.10.83	78.98
9	27.10.83	79.88
10	28.10.83	84.40
11	31.10.83	90.14

Index No.1 Pass *Index No.2* 4th Class

(b) Generator No. 14

Activity 164 GBq *Calibration Date* 17.10.83

Eluate No.	Elution Date	Elution Efficiency
1	17.10.83	96.78
2	18.10.83	98.34
3	19.10.83	95.52
4	20.10.83	94.63
5	21.10.83	94.00
6	24.10.83	94.55
7	25.10.83	94.00
8	26.10.83	87.58
9	27.10.83	81.02
10	28.10.83	80.30
11	31.10.83	83.89

Index No.1 Pass *Index No.2* 1st Class

TABLE B18
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-3A

(a) Generator No. 15

Activity 23.0 GBq *Calibration Date* 24.10.83

Eluate No.	Elution Date	Elution Efficiency
1	24.10.83	95.86
2	25.10.83	89.90
3	26.10.83	79.30
4	27.10.83	61.39
5	28.10.83	70.03
6	31.10.83	57.03
7	01.11.83	71.24
8	02.11.83	74.54
9	03.11.83	78.61
10	04.11.83	89.83
11	07.11.83.	88.32

Index No.1 Fail *Index No.2* 4th Class

(b) Generator No. 16

Activity 138.0 GBq *Calibration Date* 24.10.83

Eluate No.	Elution Date	Elution Efficiency
1	24.10.83	95.99
2	25.10.83	93.45
3	26.10.83	94.71
4	27.10.83	93.28
5	28.10.83	88.71
6	31.10.83	93.84
7	01.11.83	88.44
8	02.11.83	81.80
9	03.11.83	80.85
10	04.11.83	79.74
11	07.11.83	81.87

Index No.1 Pass *Index No.2* 2nd Class

TABLE B19
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-3B

(a) Generator No. 17

Activity 22 GBq *Calibration Date* 24.10.83

Eluate No.	Elution Date	Elution Efficiency
1	24.10.83	98.64
2	25.10.83	98.37
3	26.10.83	100.45
4	27.10.83	90.29
5	28.10.83	91.17
6	31.10.83	97.98
7	01.10.83	88.65
8	02.11.83	86.77
9	03.10.83	88.99
10	04.10.83	91.89
11	07.11.83	98.74

Index No.1 Pass *Index No.2* 3rd Class

(b) Generator No. 18

Activity 164 GBq *Calibration Date* 24.10.83

Eluate No.	Elution Date	Elution Efficiency
1	24.10.83	96.79
2	25.10.83	96.26
3	26.10.83	97.61
4	27.10.83	97.02
5	28.10.83	97.16
6	31.10.83	96.46
7	01.11.83	96.19
8	02.11.83	96.34
9	03.11.83	96.90
10	04.11.83	95.33
11	07.11.83	96.07

Index No.1 Pass *Index No.2* 1st Class

TABLE B20
GENERATOR ELUTION EFFICIENCIES FOR ^{99}Mo BATCH No. 307-4A

(a) Generator No. 19

Activity 34 GBq *Calibration Date* 31.10.83

Eluate No.	Elution Date	Elution Efficiency
1	31.11.83	90.96
2	01.11.83	92.46
3	02.11.83	91.27
4	03.11.83	88.46
5	04.11.83	83.34
6	07.11.83	84.95
7	08.11.83	86.44
8	09.11.83	86.60
9	10.11.83	90.28
10	11.11.83	91.23
11	14.11.83	90.25

Index No.1 Pass *Index No.2* 2nd Class

(b) Generator No. 20

Activity 160 GBq *Calibration Date* 30.10.83

Eluate No.	Elution Date	Elution Efficiency
1	31.10.83	95.06
2	01.11.83	91.70
3	02.11.83	91.89
4	03.11.83	92.45
5	04.11.83	91.23
6	07.11.83	92.10
7	08.11.83	91.34
8	09.11.83	90.69
9	10.11.83	88.48
10	11.11.83	85.47
11	14.11.83	88.32

Index No.1 Pass *Index No.2* 1st Class

TABLE B21
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.1 ^{99}Mo Batch 306-4A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	2.4×10^{-4}	1.4×10^{-5}	1.0×10^{-4}	n.d.	2.0×10^{-5}	2.1×10^{-5}	n.d.	3.0×10^{-6}	n.d.	n.d.
2	1.6×10^{-4}	6.0×10^{-5}	9.6×10^{-4}	n.d.	n.d.	4.0×10^{-5}	n.d.	4.0×10^{-6}	n.d.	n.d.
3	1.6×10^{-4}	7.0×10^{-5}	1.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
4	1.7×10^{-4}	7.0×10^{-5}	1.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
5	1.7×10^{-4}	8.0×10^{-5}	1.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.
6	n.d.	1.4×10^{-4}	2.9×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	n.d.	n.d.
7	1.5×10^{-4}	1.3×10^{-4}	2.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	9.0×10^{-5}	n.d.	n.d.
8	1.5×10^{-4}	1.0×10^{-4}	3.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
9	9.0×10^{-5}	1.0×10^{-4}	3.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
10	n.d	7.0×10^{-5}	2.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B22
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.2 ^{99}Mo Batch 306-4A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	5.1×10^{-3}	n.d.	2.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
2	7.0×10^{-3}	n.d.	3.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
3	7.6×10^{-3}	n.d.	5.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
4	7.1×10^{-3}	n.d.	8.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
5	6.9×10^{-3}	n.d.	8.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
6	7.9×10^{-3}	n.d.	6.4×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
7	7.7×10^{-3}	n.d.	3.5×10^{-4}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-6}	n.d.	n.d.
8	8.0×10^{-3}	1.0×10^{-4}	4.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-6}	n.d.	n.d.
9	8.6×10^{-3}	2.0×10^{-4}	7.5×10^{-4}	1.8×10^{-6}	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
10	8.4×10^{-3}	3.4×10^{-4}	7.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	3.0×10^{-5} ^{140}Ba

n.d. not detected.

TABLE B23
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.3 ^{99}Mo Batch 306-4B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.4×10^{-4}	2.1×10^{-4}	1.1×10^{-4}	n.d.	7.0×10^{-5}	4.0×10^{-5}	n.d.	1.0×10^{-6}	n.d.	n.d.
2	1.2×10^{-4}	4.8×10^{-4}	1.6×10^{-3}	n.d.	n.d.	1.0×10^{-4}	n.d.	2.0×10^{-5}	n.d.	n.d.
3	1.5×10^{-4}	5.2×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.
4	1.9×10^{-4}	5.0×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
5	2.0×10^{-4}	6.4×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.4×10^{-4}	n.d.	n.d.
6	1.2×10^{-4}	6.2×10^{-4}	2.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.1×10^{-4}	n.d.	n.d.
7	1.9×10^{-4}	6.3×10^{-4}	2.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.5×10^{-4}	n.d.	n.d.
8	1.9×10^{-4}	5.1×10^{-4}	3.1×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-4}	n.d.	n.d.
9	1.3×10^{-4}	3.8×10^{-4}	3.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.3×10^{-4}	n.d.	n.d.
10	2.6×10^{-4}	4.6×10^{-4}	2.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-3}	n.d.	n.d.

n.d. not detected.

TABLE B24
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.4 ^{99}Mo Batch 306-4B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.8×10^{-4}	7.0×10^{-5}	5.0×10^{-5}	n.d.	4.0×10^{-5}	n.d.	n.d.	4.0×10^{-6}	3.0×10^{-6}	n.d.
2	1.8×10^{-4}	3×10^{-5}	8.0×10^{-5}	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-5}	5.0×10^{-6}	4.0×10^{-6}	n.d.
3	1.9×10^{-4}	3.0×10^{-5}	1.0×10^{-4}	n.d.	1.0×10^{-5}	n.d.	1.0×10^{-5}	3.0×10^{-6}	2.0×10^{-6}	n.d.
4	1.5×10^{-4}	4.0×10^{-5}	1.0×10^{-4}	n.d.	1.0×10^{-5}	n.d.	n.d.	3.0×10^{-6}	3.0×10^{-6}	1.0×10^{-6} ^{140}La
5	2.0×10^{-4}	6.0×10^{-5}	1.1×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	3.0×10^{-6}	n.d.
6	2.0×10^{-4}	1.1×10^{-4}	1.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	5.0×10^{-6}	6×10^{-6} ^{140}La
7	2.4×10^{-4}	2.1×10^{-4}	2.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
8	3.2×10^{-4}	5.3×10^{-4}	4.2×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
9	1.1×10^{-4}	1.7×10^{-3}	1.8×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-6}	n.d.	n.d.
10	2.6×10^{-4}	1.9×10^{-3}	6.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	2×10^{-5} ^{140}La

n.d. not detected.

TABLE B25
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.5 ^{99}Mo Batch 306-4C

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	2.1×10^{-4}	1.8×10^{-4}	1.3×10^{-4}	n.d.	5.0×10^{-5}	2.0×10^{-5}	n.d.	1.0×10^{-5}	5.0×10^{-6}	n.d.
2	6.0×10^{-5}	4.3×10^{-4}	9.4×10^{-4}	n.d.	6.0×10^{-5}	4.0×10^{-5}	n.d.	1.0×10^{-5}	n.d.	n.d.
3	1.8×10^{-4}	4.3×10^{-4}	9.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
4	7.0×10^{-5}	4.2×10^{-4}	8.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
5	9.0×10^{-5}	4.6×10^{-4}	8.5×10^{-4}	n.d.	n.d.	n.d.	n.d.	8.0×10^{-5}	n.d.	n.d.
6	n.d.	6.3×10^{-4}	1.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	7.0×10^{-5}	n.d.	n.d.
7	n.d.	6.6×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
8	n.d.	5.1×10^{-4}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.3×10^{-4}	n.d.	n.d.
9	n.d.	4.3×10^{-4}	1.9×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
10	n.d.	4.0×10^{-4}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.6×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B26
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.6 ^{99}Mo Batch 306-4C

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	2.6×10^{-4}	5.0×10^{-5}	5.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	5×10^{-6}	n.d.
2	3.4×10^{-4}	2.0×10^{-5}	8.0×10^{-5}	n.d.	n.d.	n.d.	1.0×10^{-5}	7.0×10^{-6}	7.0×10^{-6}	n.d.
3	2.9×10^{-4}	2.0×10^{-5}	9.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-6}	5.0×10^{-6}	n.d.
4	2.2×10^{-4}	2.0×10^{-5}	9.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	3.9×10^{-6}	3.0×10^{-6}	n.d.
5	2.3×10^{-4}	3.0×10^{-5}	1.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	5.0×10^{-6}	n.d.
6	2.7×10^{-4}	4.0×10^{-5}	1.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	5.0×10^{-6}	n.d.
7	2.5×10^{-4}	1.0×10^{-5}	1.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	5.0×10^{-6}	n.d.
8	2.9×10^{-4}	1.9×10^{-5}	2.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	1.0×10^{-5}	n.d.
9	2.8×10^{-4}	3.8×10^{-5}	3.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
10	2.0×10^{-4}	7.7×10^{-5}	3.6×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.

n.d. not detected.

TABLE B27
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.7 ^{99}Mo Batch 307-1A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	8.8×10^{-4}	3.0×10^{-5}	1.5×10^{-4}	n.d.	3.0×10^{-5}	n.d.	n.d.	6.0×10^{-6}	n.d.	n.d.
2	9.6×10^{-4}	7.0×10^{-5}	6.1×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
3	1.3×10^{-3}	8.5×10^{-5}	7.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	n.d.
4	1.1×10^{-3}	1.3×10^{-4}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	n.d.	n.d.
5	6.6×10^{-4}	7.0×10^{-5}	5.6×10^{-4}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	n.d.	n.d.
6	6.9×10^{-4}	6.0×10^{-5}	2.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.
7	8.9×10^{-4}	n.d.	2.6×10^{-4}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.
8	1.1×10^{-3}	6.0×10^{-5}	1.1×10^{-3}	n.d.	n.d.	n.d.	n.d.	7.0×10^{-5}	n.d.	n.d.
9	1.3×10^{-3}	n.d.	5.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	7.0×10^{-5}	n.d.	n.d.
10	1.5×10^{-3}	1.3×10^{-4}	1.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	8.0×10^{-5}	n.d.	n.d.
11	1.6×10^{-3}	7.0×10^{-5}	9.5×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.4×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B28
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.8 ^{99}Mo Batch 307-1A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.2×10^{-3}	1.0×10^{-5}	6.0×10^{-5}	n.d.	2.0×10^{-5}	n.d.	n.d.	1.0×10^{-6}	n.d.	n.d.
2	1.9×10^{-3}	2.0×10^{-5}	1.0×10^{-5}	n.d.	1.0×10^{-5}	n.d.	n.d.	2.0×10^{-6}	n.d.	n.d.
3	2.3×10^{-3}	n.d.	2.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-6}	n.d.	n.d.
4	1.9×10^{-3}	n.d.	4.0×10^{-5}	n.d.	1.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d
5	1.8×10^{-3}	n.d.	4.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-6}	n.d.	n.d
6	4.7×10^{-3}	n.d.	3.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d
7	2.2×10^{-3}	3.0×10^{-5}	8.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-6}	n.d.	n.d.
8	3.6×10^{-3}	7.0×10^{-5}	9.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
9	1.9×10^{-3}	2.3×10^{-4}	1.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
10	3.2×10^{-3}	4.6×10^{-4}	4.1×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
11	4.1×10^{-3}	3.1×10^{-4}	1.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.

n.d. not detected.

TABLE B29
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.9 ^{99}Mo Batch 307-1B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.4×10^{-4}	6.0×10^{-5}	7.5×10^{-4}	n.d.	1.1×10^{-4}	3.0×10^{-5}	4.0×10^{-5}	2.0×10^{-5}	n.d.	n.d.
2	1.1×10^{-4}	1.8×10^{-4}	3.6×10^{-3}	n.d.	2.8×10^{-4}	5.0×10^{-5}	n.d.	2.0×10^{-5}	n.d.	n.d.
3	8.0×10^{-5}	3.9×10^{-4}	9.4×10^{-3}	n.d.	n.d.	4.0×10^{-5}	n.d.	2.0×10^{-5}	n.d.	n.d.
4	1.1×10^{-4}	4.2×10^{-4}	1.0×10^{-2}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	n.d.
5	9.0×10^{-5}	6.3×10^{-4}	1.4×10^{-2}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.
6	2.0×10^{-4}	9.9×10^{-4}	1.2×10^{-2}	n.d.	n.d.	n.d.	n.d.	1.5×10^{-4}	n.d.	n.d.
7	1.0×10^{-4}	4.4×10^{-4}	9.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.9×10^{-4}	n.d.	n.d.
8	9.0×10^{-5}	5.0×10^{-4}	1.2×10^{-2}	n.d.	n.d.	n.d.	n.d.	3.4×10^{-4}	n.d.	n.d.
9	1.0×10^{-4}	5.3×10^{-4}	1.5×10^{-2}	n.d.	n.d.	n.d.	n.d.	3.5×10^{-4}	n.d.	n.d.
10	1.2×10^{-4}	3.7×10^{-4}	1.7×10^{-2}	n.d.	n.d.	n.d.	n.d.	4.5×10^{-4}	n.d.	n.d.
11	2.2×10^{-4}	1.8×10^{-4}	1.4×10^{-2}	n.d.	n.d.	n.d.	n.d.	3.3×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B30
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.10 ^{99}Mo Batch 307-1B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	3.2×10^{-3}	2.0×10^{-5}	1.5×10^{-4}	n.d.	1.1×10^{-4}	n.d.	2.9×10^{-4}	2.0×10^{-5}	4.0×10^{-6}	2.0×10^{-6} ^{95}Zr
2	3.2×10^{-3}	1.0×10^{-5}	2.6×10^{-4}	n.d.	1.3×10^{-4}	n.d.	2.0×10^{-4}	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Zr
3	3.4×10^{-3}	3.0×10^{-5}	3.6×10^{-4}	n.d.	1.1×10^{-4}	n.d.	2.0×10^{-4}	1.0×10^{-5}	5.0×10^{-6}	1.0×10^{-6} ^{95}Zr
4	7.2×10^{-3}	9.0×10^{-5}	5.2×10^{-4}	n.d.	8.0×10^{-5}	n.d.	4.8×10^{-4}	2.0×10^{-5}	n.d.	3.0×10^{-6} ^{95}Zr
5	3.2×10^{-3}	1.4×10^{-4}	1.4×10^{-3}	n.d.	n.d.	n.d.	1.2×10^{-4}	1.0×10^{-5}	n.d.	n.d.
6	3.2×10^{-3}	1.3×10^{-4}	7.2×10^{-4}	n.d.	n.d.	n.d.	1.2×10^{-4}	2.0×10^{-5}	3.0×10^{-6}	n.d.
7	3.7×10^{-3}	1.9×10^{-4}	9.1×10^{-4}	n.d.	n.d.	n.d.	1.7×10^{-4}	2.0×10^{-5}	n.d.	4.0×10^{-6} ^{95}Zr
8	5.2×10^{-3}	7.3×10^{-4}	4.7×10^{-3}	n.d.	n.d.	n.d.	1.7×10^{-4}	4.0×10^{-5}	n.d.	1.0×10^{-5} ^{140}La
9	5.7×10^{-3}	1.0×10^{-3}	5.2×10^{-3}	n.d.	n.d.	n.d.	1.2×10^{-4}	7.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 4.0×10^{-6} ^{95}Zr
10	5.5×10^{-3}	1.3×10^{-3}	5.9×10^{-3}	n.d.	n.d.	n.d.	1.2×10^{-4}	1.0×10^{-4}	n.d.	2.0×10^{-6} ^{95}Nb 3.0×10^{-6} ^{95}Zr
11	2.3×10^{-3}	7.1×10^{-5}	5.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.5×10^{-4}	n.d.	3.0×10^{-6} ^{95}Zr

n.d. not detected.

TABLE B31
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.11 ^{99}Mo Batch 307-2A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	3.1×10^{-4}	3.0×10^{-5}	3.9×10^{-4}	n.d.	7.0×10^{-5}	n.d.	7.0×10^{-5}	1.0×10^{-5}	2.0×10^{-6}	n.d.
2	2.9×10^{-4}	2.0×10^{-5}	5.0×10^{-4}	n.d.	5.0×10^{-5}	n.d.	8.0×10^{-5}	1.0×10^{-5}	n.d.	n.d.
3	3.1×10^{-4}	5.0×10^{-5}	1.1×10^{-3}	n.d.	n.d.	n.d.	8.0×10^{-5}	1.0×10^{-5}	n.d.	n.d.
4	4.0×10^{-4}	7.0×10^{-5}	1.6×10^{-3}	n.d.	n.d.	n.d.	9.0×10^{-5}	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb
5	4.7×10^{-4}	1.1×10^{-4}	2.6×10^{-3}	n.d.	n.d.	n.d.	7.0×10^{-5}	1.0×10^{-5}	n.d.	n.d.
6	4.9×10^{-4}	2.2×10^{-4}	2.8×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-4}	n.d.	3.0×10^{-6} ^{95}Zr
7	5.6×10^{-4}	3.6×10^{-4}	3.8×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	n.d.
8	5.2×10^{-4}	2.9×10^{-4}	4.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-5}	n.d.	n.d.
9	5.8×10^{-4}	3.9×10^{-4}	5.1×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-5}	n.d.	n.d.
10	7.2×10^{-4}	3.5×10^{-4}	6.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	n.d.	n.d.
11	8.5×10^{-4}	3.8×10^{-4}	6.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.4×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B32
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.12 ^{99}Mo Batch 307-2A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.0×10^{-2}	n.d.	1.9×10^{-4}	n.d.	5.0×10^{-5}	n.d.	n.d.	n.d.	n.d.	n.d.
2	1.2×10^{-2}	n.d.	2.1×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
3	1.2×10^{-2}	n.d.	3.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
4	1.1×10^{-2}	n.d.	2.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
5	1.3×10^{-2}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
6	1.4×10^{-2}	n.d.	3.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
7	1.6×10^{-2}	n.d.	9.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
8	2.0×10^{-2}	n.d.	9.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
9	2.0×10^{-2}	n.d.	8.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
10	2.4×10^{-2}	1.5×10^{-4}	1.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
11	2.7×10^{-2}	1.5×10^{-4}	1.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

n.d. not detected.

TABLE B33
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.13 ^{99}Mo Batch 307-2B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	4.3×10^{-4}	2.0×10^{-5}	3.6×10^{-4}	n.d.	2.9×10^{-4}	7.0×10^{-5}	6.0×10^{-5}	2.0×10^{-5}	n.d.	n.d.
2.	2.4×10^{-4}	6.0×10^{-5}	1.6×10^{-3}	n.d.	2.9×10^{-4}	n.d.	n.d.	1.0×10^{-5}	2.0×10^{-6}	n.d.
3	3.1×10^{-4}	8.0×10^{-5}	1.5×10^{-3}	n.d.	2.2×10^{-4}	5.0×10^{-5}	4.0×10^{-4}	2.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb
4	3.5×10^{-4}	1.2×10^{-4}	2.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
5	3.3×10^{-4}	1.7×10^{-4}	3.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	n.d.
6	7.8×10^{-4}	2.2×10^{-4}	2.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	8.0×10^{-5}	n.d.	n.d.
7	3.6×10^{-4}	3.7×10^{-4}	4.8×10^{-3}	n.d.	n.d.	n.d.	n.d.	8.0×10^{-5}	n.d.	n.d.
8	3.6×10^{-4}	2.5×10^{-4}	4.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
9	5.4×10^{-4}	2.4×10^{-4}	6.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.4×10^{-4}	n.d.	n.d.
10	2.3×10^{-4}	1.6×10^{-4}	6.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.4×10^{-4}	n.d.	n.d.
11	2.9×10^{-4}	3.0×10^{-4}	6.7×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.7×10^{-4}	n.d.	n.d.

n.d. not detected.

TABLE B34
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.14 ^{99}Mo Batch 307-2B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	9.9×10^{-4}	1.0×10^{-5}	1.5×10^{-4}	n.d.	1.0×10^{-4}	n.d.	3.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6} ^{95}Zr 1.0×10^{-6} ^{95}Nb
2	7.9×10^{-4}	1.0×10^{-5}	2.5×10^{-4}	n.d.	8.0×10^{-5}	n.d.	2.0×10^{-5}	1.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6} ^{95}Zr 1.0×10^{-6} ^{95}Nb
3	9.6×10^{-4}	5.0×10^{-6}	2.8×10^{-4}	n.d.	5.0×10^{-5}	n.d.	4.0×10^{-5}	2.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6} ^{95}Zr 1.0×10^{-6} ^{95}Nb
4	1.1×10^{-3}	1.0×10^{-5}	2.8×10^{-4}	n.d.	3.0×10^{-5}	n.d.	3.0×10^{-5}	3.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
5	1.2×10^{-3}	2.0×10^{-5}	3.9×10^{-4}	n.d.	3.0×10^{-5}	n.d.	n.d.	2.0×10^{-5}	1.0×10^{-5}	1.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
6	1.3×10^{-3}	3.0×10^{-5}	3.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	1.0×10^{-5}	2.0×10^{-6} ^{95}Nb 3.0×10^{-6} ^{95}Zr
7	1.2×10^{-3}	6.0×10^{-5}	6.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-5}	1.0×10^{-5}	2.0×10^{-6} ^{95}Nb 3.0×10^{-6} ^{95}Zr
8	1.6×10^{-3}	1.9×10^{-4}	1.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	5.0×10^{-6}	2.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
9	1.9×10^{-3}	3.6×10^{-4}	1.9×10^{-3}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-5}	1.0×10^{-5}	2.0×10^{-6} ^{95}Nb 3.0×10^{-6} ^{95}Zr
10	2.0×10^{-3}	4.5×10^{-4}	2.1×10^{-3}	n.d.	n.d.	n.d.	n.d.	9.0×10^{-5}	n.d.	5.0×10^{-6} ^{95}Nb 1.0×10^{-5} ^{95}Zr
11	2.1×10^{-3}	7.3×10^{-4}	2.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.7×10^{-4}	n.d.	1.0×10^{-5} ^{95}Nb 1.0×10^{-5} ^{95}Zr

n.d. not detected.

TABLE B35
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.15 ^{99}Mo Batch 307-3A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity) ^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.9×10^{-4}	6.0×10^{-5}	4.1×10^{-4}	n.d.	1.3×10^{-4}	4.0×10^{-5}	1.0×10^{-5}	3.0×10^{-5}	n.d.	n.d.
2	1.6×10^{-4}	1.7×10^{-4}	3.1×10^{-3}	n.d.	n.d.	4.0×10^{-5}	n.d.	4.0×10^{-5}	n.d.	n.d.
3	1.6×10^{-4}	2.1×10^{-4}	6.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-4}	n.d.	n.d.
4	2.0×10^{-4}	1.3×10^{-4}	3.4×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.9×10^{-4}	n.d.	n.d.
5	1.6×10^{-4}	1.8×10^{-4}	6.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.2×10^{-4}	n.d.	n.d.
6	2.4×10^{-4}	1.2×10^{-4}	3.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.8×10^{-3}	n.d.	n.d.
7	1.9×10^{-4}	1.6×10^{-4}	4.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.5×10^{-3}	n.d.	n.d.
8	2.0×10^{-4}	1.1×10^{-4}	4.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.7×10^{-3}	n.d.	n.d.
9	2.2×10^{-4}	1.3×10^{-4}	5.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-3}	n.d.	n.d.
10	1.6×10^{-4}	1.0×10^{-4}	5.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.9×10^{-3}	n.d.	n.d.
11	1.8×10^{-4}	n.d.	4.8×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-3}	n.d.	n.d.

n.d. not detected.

TABLE B36
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.16 ^{99}Mo Batch 307-3A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity) ^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	5.8×10^{-4}	1.0×10^{-5}	1.4×10^{-4}	n.d.	3.0×10^{-5}	n.d.	n.d.	1.0×10^{-5}	1.0×10^{-6}	5.0×10^{-7} ^{95}Nb 3.0×10^{-7} ^{95}Zr
2	6.4×10^{-4}	1.0×10^{-5}	1.5×10^{-4}	n.d.	3.0×10^{-5}	n.d.	3.0×10^{-5}	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 1.0×10^{-6} ^{95}Zr
3	6.0×10^{-4}	1.0×10^{-5}	1.8×10^{-4}	n.d.	2.0×10^{-5}	n.d.	4.0×10^{-5}	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 1.0×10^{-6} ^{95}Zr
4	6.4×10^{-4}	1.0×10^{-5}	2.2×10^{-4}	n.d.	2.0×10^{-5}	n.d.	6.0×10^{-5}	1.0×10^{-5}	n.d.	5.0×10^{-7} ^{95}Nb
5	6.8×10^{-4}	3.0×10^{-5}	2.5×10^{-4}	n.d.	2.0×10^{-5}	n.d.	7.0×10^{-5}	1.0×10^{-5}	n.d.	3.0×10^{-7} ^{95}Nb
6	7.2×10^{-4}	2.0×10^{-5}	2.4×10^{-4}	n.d.	n.d.	n.d.	6.0×10^{-5}	2.0×10^{-5}	n.d.	1.5×10^{-6} ^{95}Nb 5.0×10^{-7} ^{95}Zr
7	7.8×10^{-4}	8.0×10^{-6}	6.0×10^{-5}	n.d.	n.d.	n.d.	4.0×10^{-5}	2.0×10^{-5}	n.d.	7.0×10^{-7} ^{95}Nb
8	1.0×10^{-3}	1.6×10^{-4}	1.1×10^{-3}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-5}	n.d.	3.0×10^{-6} ^{95}Nb 2.0×10^{-7} ^{95}Zr
9	8.5×10^{-4}	3.9×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-7} ^{95}Nb
10	1.0×10^{-3}	4.8×10^{-4}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
11	1.1×10^{-3}	5.4×10^{-4}	1.5×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.4×10^{-4}	n.d.	3.0×10^{-6} ^{95}Nb

n.d. not detected.

TABLE B37
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.17 ^{99}Mo Batch 307-3B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.4×10^{-4}	8.0×10^{-5}	1.3×10^{-4}	n.d.	2.4×10^{-5}	2.0×10^{-4}	2.0×10^{-5}	4.0×10^{-6}	n.d.	5.5×10^{-7} ^{95}Zr
2	1.0×10^{-4}	4.0×10^{-5}	1.4×10^{-4}	n.d.	7.0×10^{-5}	2.0×10^{-5}	2.0×10^{-5}	6.0×10^{-6}	n.d.	2.0×10^{-6} ^{95}Zr
3	8.0×10^{-5}	7.0×10^{-5}	4.3×10^{-4}	n.d.	8.0×10^{-5}	n.d.	n.d.	3.0×10^{-6}	n.d.	n.d.
4	1.0×10^{-4}	1.6×10^{-4}	7.9×10^{-4}	n.d.	1.0×10^{-4}	3.0×10^{-5}	n.d.	4.0×10^{-6}	n.d.	n.d.
5	9.0×10^{-5}	2.1×10^{-4}	1.0×10^{-3}	n.d.	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-5}	n.d.	n.d.
6	7.0×10^{-5}	2.5×10^{-4}	5.5×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
7	n.d.	3.4×10^{-4}	1.0×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
8	8.0×10^{-5}	3.3×10^{-4}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	n.d.
9	9.0×10^{-5}	3.8×10^{-4}	1.9×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
10	1.6×10^{-4}	3.9×10^{-4}	2.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	n.d.
11	n.d.	4.6×10^{-4}	2.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	6.0×10^{-5}	n.d.	n.d.

n.d. not detected.

TABLE B38
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.18 ^{99}Mo Batch 307-3B

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	3.5×10^{-4}	2.0×10^{-5}	8.0×10^{-5}	n.d.	6.0×10^{-5}	n.d.	n.d.	3.0×10^{-6}	8.0×10^{-7}	5.0×10^{-7} ^{95}Nb 1.0×10^{-7} ^{95}Zr
2	3.1×10^{-4}	1.0×10^{-5}	8.0×10^{-5}	n.d.	3.0×10^{-5}	n.d.	n.d.	2.0×10^{-6}	n.d.	2.0×10^{-7} ^{95}Nb 4.0×10^{-7} ^{95}Zr
3	3.2×10^{-4}	1.0×10^{-5}	1.4×10^{-4}	n.d.	4.0×10^{-5}	n.d.	n.d.	1.0×10^{-6}	n.d.	n.d.
4	2.8×10^{-4}	1.0×10^{-5}	1.8×10^{-4}	n.d.	2.0×10^{-5}	n.d.	n.d.	2.0×10^{-6}	8.0×10^{-7}	2.0×10^{-7} ^{95}Nb
5	2.8×10^{-4}	2.0×10^{-5}	1.1×10^{-3}	n.d.	n.d.	n.d.	1.0×10^{-5}	3.0×10^{-6}	n.d.	4.0×10^{-7} ^{95}Zr
6	2.6×10^{-4}	1.0×10^{-5}	1.4×10^{-4}	n.d.	n.d.	n.d.	n.d.	5.0×10^{-6}	n.d.	1.0×10^{-6} ^{95}Zr
7	3.0×10^{-4}	3.0×10^{-5}	2.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	4.0×10^{-6}	n.d.	1.0×10^{-6} ^{95}Nb 1.0×10^{-6} ^{95}Zr
8	2.8×10^{-4}	6.0×10^{-5}	3.2×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb
9	3.0×10^{-4}	7.0×10^{-5}	4.1×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	9.0×10^{-7} ^{95}Nb
10	3.2×10^{-4}	1.6×10^{-5}	4.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
11	3.2×10^{-4}	1.5×10^{-5}	3.6×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	7.0×10^{-6} ^{95}Nb

n.d. not detected.

TABLE B39
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.19 ^{99}Mo Batch 307-4A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)									
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	3.8×10^{-4}	3.1×10^{-4}	3.2×10^{-4}	n.d.	5.0×10^{-5}	n.d.	6.0×10^{-5}	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 5.0×10^{-6} ^{95}Zr
2	3.1×10^{-4}	2.0×10^{-4}	3.8×10^{-4}	n.d.	n.d.	n.d.	9.0×10^{-5}	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 1.0×10^{-5} ^{95}Zr
3	2.9×10^{-4}	2.2×10^{-4}	4.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 1.0×10^{-5} ^{95}Zr
4	2.3×10^{-4}	3.9×10^{-4}	6.7×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 5.0×10^{-6} ^{95}Zr
5	2.6×10^{-4}	6.4×10^{-4}	8.9×10^{-4}	n.d.	n.d.	n.d.	8.0×10^{-5}	1.0×10^{-5}	n.d.	3.0×10^{-6} ^{95}Nb 1.0×10^{-6} ^{95}Zr
6	2.9×10^{-4}	1.2×10^{-3}	9.9×10^{-4}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-5} ^{95}Nb 2.0×10^{-5} ^{95}Zr
7	1.8×10^{-4}	1.7×10^{-3}	1.3×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-5} ^{95}Nb 1.0×10^{-5} ^{95}Zr
8	1.8×10^{-4}	1.7×10^{-3}	1.6×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	1.0×10^{-5} ^{95}Nb 2.0×10^{-5} ^{95}Zr
9	n.d.	1.8×10^{-3}	2.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	1.0×10^{-5} ^{95}Nb 2.0×10^{-5} ^{95}Zr
10	2.5×10^{-4}	1.6×10^{-3}	2.0×10^{-3}	n.d.	n.d.	n.d.	n.d.	3.0×10^{-5}	n.d.	1.0×10^{-5} ^{95}Nb 4.0×10^{-5} ^{95}Zr
11	2.4×10^{-4}	1.9×10^{-3}	2.2×10^{-3}	n.d.	n.d.	n.d.	n.d.	8.0×10^{-5}	n.d.	3.0×10^{-5} ^{95}Nb 5.0×10^{-5} ^{95}Zr

n.d. not detected.

TABLE B40
RADIONUCLIDIC PURITY ANALYSIS OF GENERATOR ELUATES
Generator No.20 ^{99}Mo Batch 307-4A

Eluate No.	Radionuclidic Purity (as percentage of ^{99m}Tc activity)								
	^{99}Mo	^{131}I	^{132}I	^{132}Te	^{112}Ag	^{112}Pd	^{239}Np	^{103}Ru	^{127}Sb	Others
1	1.1×10^{-3}	1.2×10^{-3}	3.0×10^{-5}	n.d.	2.0×10^{-5}	n.d.	4.0×10^{-5}	1.0×10^{-5}	n.d.	1.0×10^{-6} ^{95}Nb 4.0×10^{-6} ^{95}Zr
2	1.2×10^{-3}	5.0×10^{-5}	5.0×10^{-5}	n.d.	2.0×10^{-5}	n.d.	5.0×10^{-5}	4.0×10^{-6}	n.d.	1.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
3	1.1×10^{-3}	3.0×10^{-5}	6.0×10^{-5}	n.d.	1.0×10^{-5}	n.d.	5.0×10^{-5}	4.0×10^{-6}	n.d.	1.0×10^{-6} ^{95}Nb 2.0×10^{-6} ^{95}Zr
4	1.1×10^{-3}	5.0×10^{-5}	8.0×10^{-5}	n.d.	n.d.	n.d.	6.0×10^{-5}	4.0×10^{-6}	n.d.	7.0×10^{-7} ^{95}Nb 2.0×10^{-6} ^{95}Zr
5	2.3×10^{-3}	1.5×10^{-4}	1.0×10^{-4}	n.d.	n.d.	n.d.	1.2×10^{-4}	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 4.0×10^{-6} ^{95}Zr
6	1.1×10^{-3}	9.0×10^{-5}	1.4×10^{-4}	n.d.	n.d.	n.d.	6.0×10^{-5}	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 4.0×10^{-6} ^{95}Zr
7	1.1×10^{-3}	2.2×10^{-4}	2.2×10^{-4}	n.d.	n.d.	n.d.	4.0×10^{-5}	1.0×10^{-5}	n.d.	4.0×10^{-6} ^{95}Nb 1.0×10^{-5} ^{95}Zr
8	1.1×10^{-3}	6.6×10^{-4}	3.3×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	2.0×10^{-6} ^{95}Nb 3.0×10^{-6} ^{95}Zr
9	1.1×10^{-3}	1.2×10^{-3}	4.5×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	5.0×10^{-6} ^{95}Nb 1.0×10^{-5} ^{95}Zr
10	1.3×10^{-3}	1.8×10^{-3}	5.4×10^{-4}	n.d.	n.d.	n.d.	n.d.	1.0×10^{-5}	n.d.	5.0×10^{-5} ^{95}Nb 1.0×10^{-5} ^{95}Zr
11	1.1×10^{-3}	4.2×10^{-3}	8.8×10^{-4}	n.d.	n.d.	n.d.	n.d.	2.0×10^{-5}	n.d.	5.0×10^{-5} ^{95}Nb 1.0×10^{-5} ^{95}Zr

n.d. not detected.

TABLE B41
BARIUM-140 and STRONTIUM-90 CONTAMINATION OF THE ELUATES

The ^{140}Ba content of the ^{99}Mo feed solutions varied from 'not detectable' to 0.021 per cent: two batches in particular showed very high ^{140}Ba contents, *viz.* 307/1B : 0.021 per cent and 307/2A : 0.014 per cent.

It was a matter of conjecture whether ^{140}Ba in the ^{99}Mo could be correlated with the presence of the radiotoxic ^{89}Sr and ^{99}Sr in the eluates. The work program was therefore extended to include $^{89}Sr/^{90}Sr$ measurements on the first eluates of Generators 1-17 and on ^{99}Mo batches 307/1B and 307/2A.

SAMPLE	% ^{89}Sr	% ^{90}Sr
^{99}Mo; 307/1B	$< 1 \times 10^{-4}$	$< 1 \times 10^{-4}$
^{99}Mo; 307/2A	$< 1 \times 10^{-4}$	$< 1 \times 10^{-4}$
Gen. 1	$< 1 \times 10^{-6}$	$< 1 \times 10^{-7}$
Gen. 2	"	"
Gen. 3	"	"
Gen. 4	"	"
Gen. 5	"	"
Gen. 6	"	"
Gen. 7	"	"
Gen. 8	"	"
Gen. 9	"	"
Gen. 10	"	"
Gen. 11	"	"
Gen. 12	"	"
Gen. 13	"	"
Gen. 14	"	"
Gen. 15	"	"
Gen. 16	"	"
Gen. 17	"	"

In demonstrating the absence of the radiostrontiums in the ^{99}Mo solutions and the first eluates of the generators, the above results prove that, despite their chemical similarity, it is not possible to use ^{140}Ba as a γ-emitting monitor for ^{90}Sr.

TABLE B42
DECONTAMINATION FACTORS FOR NOMINAL 20 GBq ^{99}Mo GENERATORS
MAJOR IMPURITIES

Generator Number	Generator Activity Bq DF	^{99}Mo Batch No.	Max ^{131}I Conc. (8 h) (%)	^{131}I DF	Max ^{102}Ru Conc. (8 h) (%)	^{103}Ru DF	Max ^{132}I Conc. (%)	^{132}I DF	Max ^{127}Sb Conc.(8 h) (%)	^{127}Sb
1	22.4	306/4A	3.5×10^{-4}	3.1	5.0×10^{-4}	65.8	3.4×10^{-3}	0.82	n.d.	-
3	22.3	306/4B	1.5×10^{-3}	1.0	2.5×10^{-3}	35.9	3.5×10^{-3}	1.9	2.5×10^{-6}	60 000
5	23.0	306/4C	1.7×10^{-3}	0.94	6.5×10^{-4}	83.7	1.9×10^{-3}	2.5	1.3×10^{-5}	13 600
7	26.0	307/1A	3.3×10^{-4}	2.9	3.5×10^{-4}	69.7	1.3×10^{-3}	0.92	n.d.	-
9	28.0	307/1B	2.5×10^{-3}	0.38	1.0×10^{-3}	227.0	1.7×10^{-2}	2.4	n.d.	-
11	27.9	307/2A	9.8×10^{-4}	1.4	3.5×10^{-4}	210.3	6.2×10^{-3}	2.8	5×10^{-6}	29 800
13	22.4	307/2B	9.3×10^{-4}	0.54	6.8×10^{-4}	71.9	6.7×10^{-3}	1.5	5.0×10^{-6}	31 400
15	23.0	307/3A	5.3×10^{-4}	2.1	1.0×10^{-2}	12.2	6.4×10^{-3}	1.9	n.d.	-
17	22.0	307/3B	1.2×10^{-3}	1.1	1.5×10^{-4}	192.7	2.3×10^{-3}	2.7	n.d.	-
19	23.0	307/4A	4.8×10^{-3}	2.7	2.0×10^{-4}	290.5	2.2×10^{-3}	1.2	n.d.	-
Minimum DF				0.38		35.9		0.82		13 600

TABLE B43
DECONTAMINATION FACTORS FOR NOMINAL 20 GBq ^{99}Mo GENERATORS
MINOR IMPURITIES

Generator Number	Generator Activity (GBq)	^{99}Mo Batch No.	Max ^{95}Zr Conc. (8 h) (%)	^{95}Zr DF	Max ^{95}Nb Conc. (8 h) (%)	^{95}Nb DF	Max ^{140}Ba Conc.(8 h) (%)	^{140}Ba DF
1	22.4	306/4A	n.d.	-	n.d.	-	n.d.	-
3	22.3	306/4B	n.d.	-	n.d.	-	n.d.	-
5	23.0	306/4C	n.d.	-	n.d.	-	n.d.	-
7	26.0	307/1A	n.d.	-	n.d.	-	n.d.	-
9	28.0	307/1B	n.d.	-	n.d.	-	n.d.	-
11	27.9	307/2A	7.5×10^{-6}	800	2.5×10^{-6}	1280	n.d.	-
13	22.4	307/2B	n.d.	-	2.5×10^{-6}	-*	n.d.	-
15	23.0	307/3A	n.d.	-	n.d.	-	n.d.	-
17	22.0	307/3B	5.0×10^{-6}	2740	n.d.	-	n.d.	-
19	23.0	307/4A	1.3×10^{-4}	141	7.5×10^{-5}	94	n.d.	-

* ^{95}Nb not detected in ^{99}Mo solution.

TABLE B44
DECONTAMINATION FACTORS FOR NOMINAL 150 GBq ^{99}Mo GENERATORS
MAJOR IMPURITIES

Generator Number	Generator Activity (SBq)	^{99}Mo Batch No.	Max ^{131}I Conc. (8 h) (%)	^{131}I DF	Max ^{103}Ru Conc. (8 h) (%)	^{103}Ru DF	Max ^{132}I Conc. (%)	^{132}I DF	Max ^{127}Sb Conc. (8 h) (%)	^{127}Sb DF
2	150	306/4A	8.5×10^{-4}	1.3	7.5×10^{-5}	439	7.9×10^{-4}	3.5	n.d.	-
4	162	306/4B	4.8×10^{-3}	0.31	7.5×10^{-5}	1196	1.8×10^{-3}	3.7	1.3×10^{-5}	11 540
6	163	306/4C	1.9×10^{-3}	0.81	5.0×10^{-5}	1088	3.7×10^{-4}	13.0	2.5×10^{-5}	7 080
8	177	307/1A	1.2×10^{-3}	0.80	2.5×10^{-5}	922	1.7×10^{-4}	7.0	n.d.	-
10	172	307/1B	3.3×10^{-3}	0.28	3.8 x 10–4	597	5.9×10^{-3}	6.8	1.3×10^{-5}	10 850
12	164	307/2A	3.8×10^{-4}	3.7	n.d.	-	1.2×10^{-3}	14.3	n.d.	-
14	164.5	307/2B	1.8×10^{-3}	0.28	6.8×10^{-4}	72	2.3×10^{-3}	4.3	2.5×10^{-5}	6 280
16	138	307/3A	1.4×10^{-3}	0.79	3.5×10^{-3}	349	1.6×10^{-3}	7.5	2.5×10^{-6}	37 600
18	164	307/3B	4.0×10^{-4}	3.3	5.0×10^{-5}	578	1.1×10^{-3}	5.6	2.0×10^{-6}	28 750
20	160	307/4A	1.1×10^{-2}	1.2	5.0×10^{-5}	658	8.8×10^{-4}	3.2	n.d.	-
Min. DF				0.28		72		3.2		6280

TABLE B45
DECONTAMINATION FACTORS FOR NOMINAL 150 GBq ^{99}Mo GENERATORS
MINOR IMPURITIES

Generator Number	Generator Activity	^{99}Mo Batch (GBq)	Max ^{95}Zr No. (%)	^{95}Zr Conc. (8 h)	Max ^{95}Nb DF (%)	^{95}Nb Conc. (8 h) DF	Max ^{140}Ba Conc. (8 h) (%)	^{140}Ba DF
2	150	306.4A	n.d.	-	n.d.	-	7.5×10^{-5}	45
4	162	306/4B	n.d.	-	n.d.	-	5.0×10^{-5}	72
6	163	306/4C	n.d.	-	n.d.	-	n.d.	-
8	177	307/1A	n.d.	-	n.d.	-	n.d.	-
10	172	307/1B	1×10^{-5}	800	2.5×10^{-6}	1200	2.5×10^{-5}	840
12	164	307/2A	n.d.	-	n.d.	-	n.d.	-
14	164.5	307/2B	2.5×10^{-5}	-*	2.5×10^{-5}	-**	n.d.	-
16	138	307/3A	2.5×10^{-6}	3280	7.5×10^{-6}	733	n.d.	-
18	164	307/3B	5×10^{-6}	2740	1.8×10^{-5}	450	n.d.	-
20	160	307/4A	2.5×10^{-5}	732	2.5×10^{-5}	732	n.d.	-

* ^{95}Zr not detected in ^{99}Mo;
** ^{95}Nb not detected in ^{99}Mo.

APPENDIX C
HALF-LIVES OF RADIONUCLIDES

Isotope	Half-life
^{99m}Tc	6.02 h
^{99}Mo	66.02 h
^{131}I	8.04 d
^{132}I	2.29 h
^{132}Te	78 h
^{127}Sb	3.80 d
^{95}Zr	3.50 d
^{95}Nb	64.0 d
^{140}Ba	12.79 d