

INTERNATIONAL ATOMIC ENERGY AGENCY

PROCEDURE OF IAEA/SSDL INTERCOMPARISON OF THERAPY LEVEL IONIZATION CHAMBER CALIBRATION FACTORS

1. OBJECTIVES

The aim of the intercomparison is to verify that the SSDL can carry out calibrations within acceptable limits. Using this procedure, it is also verified that proper traceability exists to primary standards.

At the present time, for therapy level dosimetry, routine calibrations of radiotherapy dosimeters at the SSDLs are carried out in ^{60}Co gamma beams exclusively in terms of air kerma free in air.

There has been a world-wide development of calibration techniques directly in terms of absorbed dose to water and the tendency to replace air kerma by absorbed dose to water as the calibration quantity. In the most direct approach, calibrations would be performed in a water phantom directly at different high-energy beam qualities against absorbed dose to water standards. However, due to the good stability and the world-wide easy availability of ^{60}Co gamma beams for calibrations, a more practical approach has been proposed which relies on direct absorbed dose to water calibration at ^{60}Co gamma beams, with subsequent evaluation of calibration factors for other beam qualities using an appropriate radiation quality correction factor.

In recent years, direct absorbed dose to water calibrations at ^{60}Co gamma beams have been introduced by the PSDLs and have been available also for the calibration of the secondary standards of the SSDLs. Before the routine implementation of the new calibration techniques, however, appropriate codes of practice for clinical dose measurements have to be developed. It will also be of high importance to collect experiences on the new calibrations in order to evaluate the impact of the new method on clinical dose determination, i.e. on the dose delivered to the patient. This intercomparison for the direct absorbed dose to water calibrations is aimed at helping the SSDLs identifying problems in the dissemination of calibration factors according to the new approach and to prepare them for the actual implementation of the new techniques in the future.

SSDLs that cannot calibrate in terms of absorbed dose to water could calculate the $N_{D,w}$ factor from the air kerma calibration factor, N_K , using the IAEA TRS-277 dosimetry protocol, i.e.,

$$N_{D,w} = N_K (1 - g) k_{att} k_m (s_{w,air})_Q P_Q \cdot$$

(Q stands for Co-60).

Should the IAEA protocol not be used in the SSDL's country, please determine $N_{D,w}$ according to:

$$N_{D,w} = D_w / M_Q$$

where D_w is determined according to the local dosimetry protocol (clearly state which protocol was used) and M_Q is the corrected meter reading during the calibration.

Details of the calculations should be sent to the IAEA together with the chamber. (Please use the attached worksheet.)

2. GENERAL REQUIREMENTS

An SSDL that will participate in the intercomparison for therapy level should have the following equipment:

1. Therapy level ^{60}Co gamma beam irradiation device or access to a ^{60}Co therapy unit at a hospital
2. Therapy level working or reference standard ionization chamber and electrometer routinely used in calibrations
3. Devices to set precisely the field size and the source to chamber distance and to position the phantom in the case of absorbed dose
4. Barometer
5. Thermometer
6. Field class ionization chamber with build-up cap that belongs to the chamber design
7. Check source for use with the above mentioned field class ionization chamber

SSDLs that would like to participate in direct $N_{D,w}$ calibrations should also have access to:

8. A water phantom with minimum dimensions of 30 cm x 30 cm x 30 cm and a PMMA waterproof sleeve for the chamber .

It is also emphasised that only field class chambers should be used as transfer chambers in the intercomparison, and not the chambers used as the reference or working standard of the SSDL. Usually, a working standard is used for the measurement of air kerma or absorbed dose to water (see IAEA TRS 374), while the reference standard could be used if the SSDL has only one standard class chamber. The field class ionization chamber to be used in the intercomparison should be one of the types reported in the IAEA TRS 277.

SSDLs that can only provide a SYSTEM calibration factor, i.e. a calibration factor for the combination of electrometer plus ionization chamber (Gy/scale division), will be supplied temporarily and upon request, with a specially designed constant current source for checking their electrometer. (NOTE that this current source can be used only for checking but *not* for the *calibration* of the electrometer.) The IAEA should be notified well in advance if an SSDL will need such a current source.

The procedures to be applied in the intercomparison are described below in detail for both air kerma and absorbed dose to water calibrations. It should be noted, however, that it is advisable to carry out both type of calibrations during the same experimental session using the same chamber. Part of the procedures (e.g. check source measurements) will then become duplicate and in practice only need to be performed once.

INTERNATIONAL ATOMIC ENERGY AGENCY

3. INTERCOMPARISON FOR AIR KERMA CALIBRATION FACTORS

3.1 Reference conditions

For conformity and practical reasons, the following geometrical reference conditions are recommended for ^{60}Co gamma beams (see Fig 1):

1. Source to chamber distance (SCD): 100 cm
2. Field size at SCD: 10 cm x 10 cm
3. Chamber reference point for calibration: chamber geometrical centre.

If it is impossible for an SSDL to observe the above conditions, the deviations shall be reported in the worksheet.

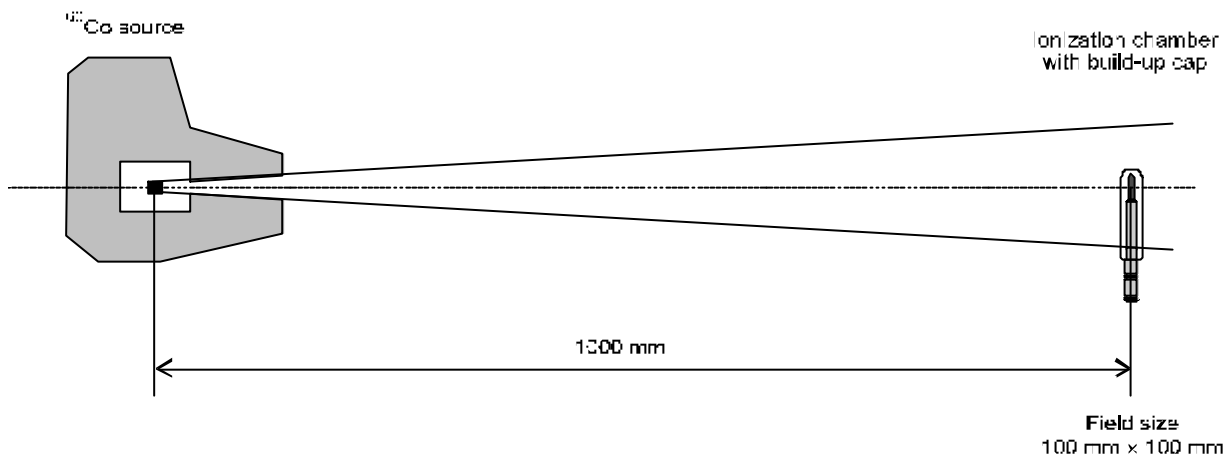


Fig. 1. The set-up for calibration and the reference conditions for the air kerma calibration factor.

3.2 Procedures

For all reporting of data and results, the worksheets given as Attachments 1 and 2 shall be used.

3.2.1 Procedures at the SSDL prior to sending the chamber to the IAEA

- Fill in the data on the chamber and the laboratory (part A of the worksheet).
- Make a check source measurement for the chamber to be calibrated in this audit and record the results (part B of the worksheet).
- Calibrate the chamber intended for participation in the intercomparison in terms of air kerma in the SSDL's ^{60}Co gamma beam in accordance with the normal calibration procedure applied at the SSDL, and record the results together with the estimated uncertainties (part C of the worksheet). Also record information on the SSDL's standards (on the reference standard in case the SSDL has only one standard chamber) (part C of the worksheet).

The air kerma calibration factor to be recorded is calculated by:

$$N_K = K_{\text{air}} / M_{\text{Co}} ,$$

where K_{air} is the air kerma determined by the standard and M_{Co} is the charge or reading from the chamber to be calibrated, corrected for the reference values of 20°C and 101.3 kPa of ambient temperature and air pressure. It is assumed that the ambient air in the room at the time of calibration is moist (20% to 80% relative humidity).

3.2.2 Sending the chamber to the IAEA

- Send the calibrated chamber, properly packed, with a copy of the worksheet (keep the original to report the results of the second calibration) shortly after the calibration, by courier mail, to the Dosimetry and Medical Radiation Physics Section (DMRP) of the IAEA. The exact address is given in the worksheet. The copy of the worksheet can also be sent separately by mail. Estimate about one week for the delivery. Make sure the shipment is insured properly. Both the shipment from the SSDL to the IAEA and the insurance are at the cost of the participant.
- Confirm *promptly* the shipment by fax or e-mail to the DMRP Section of the IAEA (see contact numbers on the worksheet) stating mailing number or whatever mailing identification might be relevant (to be used if shipment problems occur).
- Make sure to notify the DMRP Section if a specific procedure needs to be followed for customs clearance when the chamber is returned to the country of origin.

3.2.3 Procedures at the IAEA.

- The Dosimetry Laboratory performs calibrations in terms of air kerma traceable to BIPM.
- The calculations on the work sheet will be verified by the staff of the DMRP Section.
- The chamber will be returned, by courier mail, directly after the IAEA calibration. The IAEA will inform the SSDL on the shipment by e-mail or fax. Both the return shipment and the insurance will be at the cost of the IAEA.

3.2.4 Procedures at the SSDL upon arrival of the returned chambers

- As soon as possible after the return of the transfer chamber, check the chamber for transport damages (by visual inspection) and perform a check source measurement (part D of the worksheet). Compare the result with that of the check source measurement made prior to sending the chamber to the IAEA (see part B of the worksheet). If the discrepancy in the readings exceeds the SSDL's internal action level, please notify the IAEA.
- Calibrate the chamber again for air kerma as in point (1) above and record the results (part E of the worksheet). Compare the result with that of the calibration made prior to sending the chamber to the IAEA (see part C of the worksheet). The idea of making calibrations both before sending the chamber and upon return, is to exclude anomalies due to transportation problems. To some extent, this will also give an indication of the reproducibility of the calibrations.
- Report all results to the IAEA using the same worksheet (i.e. complete the worksheet).

3.2.5 Reporting of the results by the IAEA

- The results will be transmitted to each participant individually only after the results of the second calibration by the participant have arrived at the IAEA. A sample of the form, used by the IAEA

INTERNATIONAL ATOMIC ENERGY AGENCY

to report the final results, is attached (Attachment 3). In case the results exceed the action level for major deviations (see Section 5), the IAEA will contact the SSDL immediately.

- An anonymous overview of the results by all participants will be published periodically in the SSDL Newsletter.

4. INTERCOMPARISON FOR DIRECT ABSORBED DOSE TO WATER CALIBRATION FACTORS

4.1 Reference conditions

For conformity and practical reasons, the following geometrical reference conditions are recommended for ^{60}Co gamma beams (see Fig.2):

1. Source to chamber distance (SCD): 100 cm
2. Field size at SCD: 10 cm x 10 cm
3. Chamber reference point for calibration: chamber geometrical centre
4. Depth in water of the geometrical centre of the chamber: 5 g/cm² (including any entrance window of plastic corrected to equivalent thickness of water).

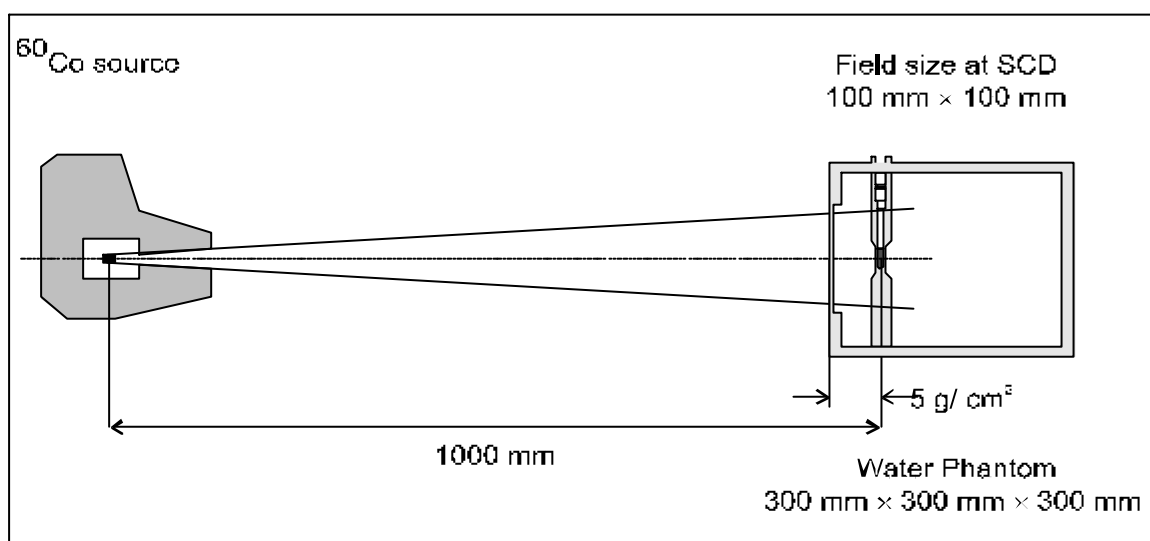


Fig. 2. Set-up for calibration and the reference conditions for the absorbed dose to water calibration.

If it is impossible for an SSDL to observe the above conditions, the deviations shall be reported in the worksheet.

4.2 Procedures

For all reporting of data and results, the worksheet supplied by the IAEA shall be used.

4.2.1 Procedures at the SSDL prior to sending the chamber to the IAEA

- Fill in the data on the chamber and the laboratory (part A of the worksheet).

- Make a check source measurement for the chamber to be calibrated in this intercomparison and record the results (part B of the worksheet).
- Calibrate the chamber in terms of absorbed dose to water, in the SSDL's ^{60}Co gamma beam and record the results together with the estimated uncertainties (part C of the worksheet). Also record information on the SSDL's standards (on the reference standard in case the SSDL has only one standard chamber, part C of the worksheet). In case the SSDL uses a correction factor for the calibration factor of its secondary standard, that is derived by calculation from its air kerma calibration factor, indicate in the worksheet which Code of Practice of dosimetry was used for the calculation.

The absorbed dose to water calibration factor $N_{D,w}$ for the chamber to be calibrated is calculated from the equation:

$$N_{D,w} = D_w / M_{Co,f} ,$$

where D_w is the absorbed dose to water derived from measurements by the standard and $M_{Co,f}$ is the charge or reading of the chamber to be calibrated, corrected for the reference conditions of temperature and air pressure (20°C and 101.3 kPa). It is assumed that the ambient air in the room at the time of calibration is moist (relative humidity between 20% and 80%). Record the results together with the estimated uncertainty in part C of the worksheet.

4.2.2 Sending the chamber to the IAEA

- Send the calibrated chamber, properly packed, with a copy of the worksheet (keep the original to report the results of the second calibration) shortly after the calibration, by courier mail, to the IAEA. The exact address is given in the worksheet. The copy of the worksheet can also be sent separately by mail. Estimate about one week for the delivery. Make sure the shipment is insured properly. Both the shipment from the SSDL to the IAEA and the insurance are at the cost of the participant.
- Confirm *promptly* the shipment by fax or e-mail to the DMRP Section of the IAEA (see contact numbers on the worksheet) stating mailing number or whatever mailing identification might be relevant (to be used if shipment problems occur).
- Make sure to notify the DMRP Section if a specific procedure needs to be followed for customs clearance when the chamber is returned to the country of origin.

4.2.3 Procedures at the IAEA Dosimetry Laboratory

- The Dosimetry Laboratory performs calibrations in terms of absorbed dose to water traceable to BIPM.
- The calculations on the work sheet will be verified by the staff of the DMRP.
- The chamber will be returned, by courier mail, directly after the IAEA calibration. The IAEA will inform the SSDL of the shipment by e-mail or fax. Both the return shipment and the insurance will be at the cost of the IAEA.

4.2.4 Procedures at the SSDL upon arrival of the returned chambers

- As soon as possible after the return of the transfer chamber, check the chamber for transport damages (by visual inspection) and perform a check source measurement (part D of the worksheet). Compare the result with that of the check source measurement made prior to sending

INTERNATIONAL ATOMIC ENERGY AGENCY

the chamber to the IAEA (see part B of the worksheet). If the discrepancy in the readings exceeds the internal action level of the SSDL, please notify the IAEA.

- Calibrate the chamber again for absorbed dose to water as in point (1) above and record the results (part E of the worksheet). Compare the result with that of the calibration made prior to sending the chamber to the IAEA (see part C of the worksheet). The idea of making calibrations both before sending the chamber and upon return, is to exclude anomalies due to transportation problems. It will also give an indication of the reproducibility of the calibrations to some extent.
- Report all results using the same worksheet to the IAEA.

4.2.5 Reporting of the results by the IAEA

- The results will be transmitted to each participant individually only after the results of the second calibration by the participant have arrived at the IAEA.
- An anonymous overview of the results obtained by all participants will be published periodically in the SSDL Newsletter.

5. ACTION LEVELS

In order to ensure uniformity among the SSDL network members, it is necessary to verify that the SSDLs perform calibrations within reasonable tolerances. These tolerances are meant to reflect levels that are routinely achievable and to be consistent with the protection of human health since SSDLs frequently disseminate standards to cancer treatment centres. The percentage deviation from unity of the ratio of the calibration factors determined at the SSDL and the IAEA shall be used to establish an action level. This percentage deviation must be equal to or less than 1.5%. Deviations larger than 1.5% will be classified as major. Such deviations will be reported by the IAEA to the SSDL immediately. The SSDL will follow up these deviations in an attempt to reconcile them as outlined in section 6. One of the duties of being a full member of the SSDL network is to perform this comparison successfully. Deviations equal to or less than 1.5% will be classified as minor and will be reported to the SSDL for their own analysis and follow up.

The IAEA standards are traceable to those of the BIPM. SSDLs whose standards are traceable to those of other PSDLs may show deviations as a result of differences between these primary standards. The published values of the difference between the standards of the BIPM and the particular PSDL used by the SSDL will be taken into account when computing the ratio between the SSDL and the IAEA.

The value of 1.5% was established based on data taken from TRS 374, Table IV. It is expected that the SSDL combined standard uncertainty will be about 0.8% at the level of one standard deviation. The additional uncertainty due to calibrating the SSDL's chamber at the IAEA is not expected to increase the uncertainty in the ratio significantly. Consequently, using a coverage factor of $k=2$, the action level was set at the value 1.5%.

The SSDL performs the calibration before and after the calibration performed at the IAEA. The value reported for the SSDL in the results form will be the mean of these two comparisons. It is also necessary that the difference between these two determinations be less than 1.5%. Again, this is expected to be readily achievable based on the uncertainty assessment outlined in TRS 374, Table IV.

6. RECONCILIATION OF DISCREPANCIES

Minor discrepancies will be left to the discretion of the SSDL. However, major deviations will require reconciliation before the IAEA will issue the results form. The process of reconciliation is a collaborative effort with the IAEA attempting to help the SSDL understand the cause of the deviation. The trouble shooting process may contain some of the steps outlined below.

- The SSDL will review thoroughly all the data sheets sent to the IAEA in order to confirm their accuracy. This will include searching for errors in arithmetic as well as in the description of the measurement conditions that might affect the outcome of the results. It would include verification of the accuracy of the data transcribed from laboratory books to the data sheets. This would entail a systematic review of the data to ensure that all steps in the measurement protocol had been done as planned.
- The SSDL will review the historical values of the calibration factor of the transfer chamber in question in order to show that its present value is consistent with the expected value. If the discrepancy remains unresolved, the probable causes are that the chamber being used in the comparison was damaged in transit or that the value of radiation intensity is inaccurate. Because the latter situation may be dangerous to human health, it is anticipated that the SSDL would cease temporarily dissemination of standards and advise people using its standards of the potential problem.
- The SSDL would use its reference or working standard to determine the output of the machine used to calibrate the transfer chamber in question. If the output of the machine as now measured, is not the expected value, repairs will be made to the machine and the calibration process repeated.
- If the output of the machine appears to be consistent, the SSDL will verify that, when used with the check source, the response of the transfer chamber is consistent, and will calibrate the chamber again.
- If the value of this second calibration factor is the same as was determined prior to sending the chamber to the IAEA, it implies that the machine output is incorrect. This could be because the reference standard is improperly calibrated. Consequently, the SSDL will send the reference standard to the IAEA or a PSDL for calibration.
- If the value of the calibration factor for the reference standard is consistent with its original calibration, there may be a real problem with the source output or the SSDL may need help in measuring properly the source output. On the other hand, if the value of the calibration factor for the reference standard is different than originally measured, it will be returned to the SSDL and a new value of the source output will be determined. This value will be used to recalculate the calibration factor for the ionization chamber used in the original comparison. If this revised value of the ratio is within the 1.5% limits stated above, the discrepancy will have been successfully resolved. Otherwise, the new value of the machine output will be used and the comparison process will be repeated.

INTERNATIONAL ATOMIC ENERGY AGENCY

7. FREQUENCY OF INTERCOMPARISONS

In order to maintain confidence in the traceability chain, it is recommended that an SSDL participate in the intercomparison programme at least every two years.

8. CORRECTING FOR DIFFERENCES IN THE REFERENCE STANDARDS

The ratio of the calibration factors determined by an SSDL and the IAEA is meant to be used as a criterion to judge the metrological quality of the calibrations performed by the SSDL. In principle, it is possible for an SSDL to establish traceability to any PSDL and to not base its measurement standard on those of the IAEA (or of the BIPM to which the IAEA is traceable). Consequently, it is necessary to account for any difference between the particular standard at the PSDL used by the SSDL and the corresponding standard of the IAEA. This section deals with the way in which the IAEA will account for this difference in the standard of the PSDL and the BIPM.

The scientific literature contains reports describing the comparison of the radiation measurement standards of various PSDLs and the BIPM. It is possible to define a correction factor, $k_{\text{BIPM/PSDL}}$ which is the ratio of the value of a radiation quantity measured by the BIPM divided by that measured by the PSDL. In the case where the comparison has been mediated by transfer ionization chambers, this correction factor is the ratio of the calibration factors determined at the BIPM and at the PSDL. The results of the comparison between the SSDL and the IAEA will be multiplied by $k_{\text{BIPM/PSDL}}$ and given in the final report.

If it is necessary to apply such a correction factor, there will be an additional uncertainty because of the statistical fluctuations expected in the results of the comparison involving the PSDL and the BIPM. Given that PSDLs demonstrate typically a statistical uncertainty in calibrating a transfer chamber of the order 0.1%, the statistical uncertainty, u_k , in the correction factor will be about 0.14% (since measurements have to be made at both the PSDL and the BIPM). This amount must be added to the uncertainty in the ratio of the comparison between the IAEA and an SSDL whose calibration is traceable to a PSDL other than the BIPM.

9. ESTIMATING UNCERTAINTIES

The participant in the intercomparison with the IAEA is responsible for reporting the uncertainty of their calibration factor. In the IAEA form used to report the results of the intercomparison (a sample is attached), the “participant stated calibration factor” will be the mean of the values determined before and after the calibration done at the IAEA. The uncertainty in the mean, u_m , will be determined at the IAEA by analyzing the results as reported by the SSDL. The portion of that uncertainty due to statistical variation in the results will be combined with the statistical uncertainty in the value of the calibration factor determined at the IAEA, u_{IAEA} , and with the statistical uncertainty, u_k , arising when the SSDL standards are traceable to a PSDL other than the BIPM (outlined in section 8). The result of adding these three components in quadrature will be u_r , the statistical uncertainty in the ratio of the calibration factors of the SSDL and the IAEA. In case the dosimetry standards of the SSDL are traceable to the BIPM, u_r , will have only two components.

WORKSHEET to report

AIR KERMA CALIBRATION FACTOR

Part A. Information on the participant

Name of the SSDL: _____
Head of the SSDL: _____
Contact person: _____

Return address: _____

Tel.no: _____ e-mail: _____
Fax no: _____

Data on the **transfer** chamber:

Type (=model): _____ Used with electrometer:
Serial No: _____ Type: _____
Serial No: _____
Polarizing voltage (magnitude and the sign of the charge collected): _____

Part B. Check source measurement for the participating chamber

Check source type: _____ Serial No: _____

Check source reading normalized to 20°C and 101.3 kPa: _____

Date of measurement: _____ Carried out by: _____ Signed: _____

Part C. Air kerma calibration before sending the chamber to the IAEA

Data on your **standard** chambers:

	Reference standard	Working standard
Type of chamber:	_____	_____
Serial no:	_____	_____
Calibrated at:	_____	_____
(name of the calibration laboratory)		
Calibration date:	_____	_____

Calibration data for the **transfer** chamber:

Air kerma rate: _____ mGy/s
Reading (current or scale div/unit time) for the chamber
calibrated (Corr. for temperature, pressure and recombination): _____
Air kerma calibration factor N_K = _____ Estimated combined
(at 20°C and 101.3 kPa): _____ uncertainty of N_K , %: _____
(1 std)
Date of calibration: _____ Carried out by: _____ Signed: _____

INTERNATIONAL ATOMIC ENERGY AGENCY

Part D. Check source measurement for the participating chamber

Check source reading normalized to 20°C and 101.3 kPa: _____

Date of measurement: _____ Carried out by: _____ Signed: _____

Part E. Air kerma calibration after the return of the chamber from the IAEA

*Calibration data for the **transfer** chamber:*

Air kerma rate: _____ mGy/s

Reading (current or scale div/unit time) for the chamber calibrated (Corr. for temperature, pressure and recombination): _____

Air kerma calibration factor $N_{K=}$ (at 20°C and 101.3 kPa): _____ Estimated combined uncertainty of $N_{K=}$, %: _____ (1 std)

Date of calibration: _____ Carried out by: _____ Signed: _____

ADDITIONAL INFORMATION:

(Please use this space to report any deviations from the recommended procedures or any other information relevant to the above procedures)

Mailing address for all communications regarding this intercomparison:

**SSDL Project Officer
Dosimetry and Medical Radiation Physics Section
International Atomic Energy Agency
Wagramer Strasse 5
P.O. Box 100
A-1400 Vienna
AUSTRIA**

E-mail: A.Meghzifene@IAEA.org or to the DMRP Section : dosimetry@iaea.org
Fax: + 43 1 2600 7
Tel: +43 1 2600 21653

WORKSHEET to report

ABSORBED DOSE TO WATER CALIBRATION FACTOR

Part A. Information on the participant

Name of the SSDL: _____
 Head of the SSDL: _____
 Contact person: _____
 Return address: _____

 Tel.no: _____ e-mail: _____
 Fax no: _____

Data on the transfer chamber:

Type (=model): _____ Used with electrometer: _____
 Serial No: _____ Type: _____
 Serial No: _____
 Polarizing voltage (magnitude and the sign of the charge collected): _____

Part B. Check source measurements for the participating chamber

Check source type: _____ Serial No: _____
 Check source reading normalized to 20°C and 101.3 kPa: _____
 Date of measurement: _____ Carried out by: _____ Signed: _____

Part C. Absorbed dose to water calibration before sending the chamber to the IAEA

Data on your standard chambers:

	Reference standard	Working standard
Type of chamber:	_____	_____
Serial no:	_____	_____
Calibrated at:	_____	_____
(name of the calibration laboratory)		
Calibration date:	_____	_____

Calibration data for the transfer chamber :

Absorbed dose rate to water: _____ mGy/s
 Reading (current or scale div/unit time) for the chamber calibrated (Corr. for temperature, pressure and recombination): _____
 Absorbed dose to water calibration factor $N_{D,w}$ (at 20°C and _____): _____
 Estimated combined uncertainty of $N_{D,w}$, %: _____ (1 std)
 Date of calibration: _____ Carried out by: _____ Signed: _____

INTERNATIONAL ATOMIC ENERGY AGENCY

Part D. Check source measurement for the participating chamber

Check source reading normalized to 20°C and 101.3 kPa: _____

Date of measurement: _____ Carried out by: _____ Signed: _____

Part E. Absorbed dose to water calibration after return of the chamber from the IAEA

*Calibration data for the **transfer** chamber:*

Absorbed dose rate to water: _____ mGy/s

Reading (current or scale div/unit time) for the chamber calibrated (Corr. for temperature, pressure and recombination): _____

Absorbed dose to water calibration factor $N_{D,w}$ (at 20°C and 101.3 kPa): _____ Estimated combined uncertainty of $N_{D,w}$, %: _____

(1 stv)

Date of calibration: _____ Carried out by: _____ Signed: _____

ADDITIONAL INFORMATION:

(Please use this space to report any deviations from the recommended procedures, the Code of Practice for dosimetry which you applied in case you determined absorbed dose rate to water by calculation from air kerma, or any other information relevant to the procedures)

Mailing address for all communications regarding this intercomparison:

**SSDL Project Officer
Dosimetry and Medical Radiation Physics Section
International Atomic Energy Agency
Wagramer Strasse 5
P.O. Box 100
A-1400 Vienna
AUSTRIA**

E-mail: A.Meghzifene@IAEA.org or to the DMRP Section : dosimetry@iaea.org
Fax: + 43 1 2600 7
Te: + 43 1 2600 21653