出國報告（出國類別：開會）

赴荷蘭參加第五屆歐洲輻射防護組織國際會議（5th European IRPA Congress）

服務機關：行政院原子能委員會

姓名職稱：梁詠慈 薦任六職等技士

派赴國家/地區：荷蘭/海牙

出國期間：107 年 6 月 1 日至 6 月 10 日

報告日期：107 年 8 月 28 日

摘要

IRPA（International Radiation Protection Association）主要目的是針對輻射防護建立的國際溝通平台，希望各國藉此組織可互相交流並改進，組織會員分佈研究類別包括輻射科學、醫療輻射、核子工程、輻射相關技術、輻射防護實務操作以及各國法規程序等等。IRPA 會員分佈全球 67 個國家、52 個組織、共 18000 名會員。

本次奉派赴荷蘭參與 5th European IRPA Congress，會議於荷蘭行政中心海牙市舉行，邀請國際專家學者就醫療、工業、天然放射性物質、非游離輻射等相關研究及管理等進行專題演講及分享；藉參與本次會議，提昇本會輻防業務人員瞭解國際輻射防護執行現況、相應管制措施以及劑量監測系統之發展，以利我國輻防管制及法規之精進，並順利與國際接軌。

目次

壹、出國目的與行程

一、　出國目的

2012 年 ICRP 103 modification 建議輻射工作人員眼球水晶體等價劑量限值應修訂為每連續 5 年週期眼球水晶體等價劑量不得超過 100mSv；每單年眼球水晶體等價劑量不得超過 50 mSv。國際間近幾年來紛紛因應此建議進行大量研究調查、修訂法規及管理規範。而國際研究結果多數顯示眼球水晶體等價劑量限值下修所受影響之關鍵群組為執行介入性放射醫療業務之輻射工作人員；故其對醫療院所輻防管制之影響尤其重要。本次奉派參與 5th European IRPA Congress，期藉由各國專家學者的專題演講及分享，瞭解歐洲國家對於眼球水晶體等價劑量限值修訂的立法過程、行政管理規劃、新法規推廣教育以及相關配套措施等等，供本會後續輻防法規修訂參考。

二、　出國行程

日期	地點	工作內容
107.06.01-02	桃園－荷蘭海牙市	路程 （桃園－阿姆斯特丹－海牙）
107.06.03	荷蘭海牙市	假日資料準備
107.06.04-08	荷蘭海牙市	參加 5th European IRPA Congress
107.06.09-10	荷蘭海牙市－桃園	路程 （海牙－阿姆斯特丹－桃園）

貳、 5th European IRPA Congress 會議內容

一、 5th European IRPA Congress 簡介

IRPA（International Radiation Protection Association）主要目的是針對輻射防護建立的國際溝通平台，希望各國藉此組織可互相交流並改進，組織會員分佈研究類別包括輻射科學、醫療輻射、核子工程、輻射相關技術、輻射防護實務操作以及各國法規程序等等。IRPA 會員分佈全球 67 個國家、52 個組織、共 18000 名會員。而本次會議 5th European IRPA Congress 主辦單位為 The Dutch Society for Radiation Protectin（NVS），NVS 是 IRPA 的其中一個會員組織（荷蘭輻防研究組織），成立於 1960 年；主要針對醫療輻射及核子工業進行相關研究。本次會議主要分 3 個主題。1. 眼球水晶體等價劑量相關輻防。2. 天然放射性物質測量及管制；3. 輻射防護教學。

各大主題中以眼球水晶體等價劑量相關內容與醫用科後續行政執行上有重要應用，故本次會講參與課程以眼球水晶體等價劑量為主。

圖 1. 5th European IRPA Congress

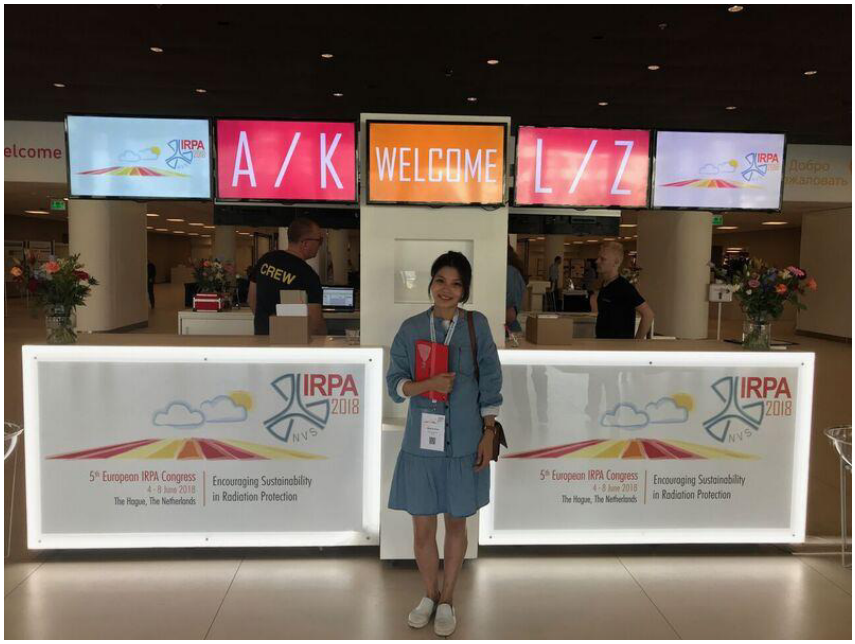

圖 2. 5th European IRPA Congress 會場

二、 5th European IRPA Congress 會議內容

European IRPA 對眼球水晶體等價劑量監測的建議方式及討論

ICRP103 提出建議：輻射工作人員眼球水晶體等價劑量應下修為每連續 5 年週期眼球水晶體等價劑量不得超過 100mSv；每單年眼球水晶體等價劑量不得超過 50 mSv。)

EU BSS 就 ICRP103 提出之眼球水晶體等價劑量限值修改建議，於 EU BSS art. 41 報告指出；當類別 A 之輻射工作人員眼球水晶體容易接受到大量輻射曝露時，應建立適當的監測系統，以確保眼球水晶體等價劑量不起過劑量限制。【EU BSS art. 41: When category A workers are liable to receive a significant exposure of the lens of the eye, an adequate system for monitoring shall be set up to ensure that the dose remains under the dose limit.】

輻射工作人員類別 A：每年有效劑量可能接受 6 mSv 以上；或，每年接受眼球水晶體等價劑量達 15mSv 以上；又或，每年接受四肢等價劑量達 150mSv 以上之輻射工作人員。

而 IRPA 對於 ICRP 這項建議在這幾年來作出積極之回應；對輻射工作人員眼球水晶體等價劑量監測分二階段進行研究評估：

第一階段（2012-2014）:針對輻射作業場所建立完整及可行的輻防觀念。

第二階段（2015-2017）:建立工作人員對眼球水晶體的輻防意識及修訂劑量限值。

對於第一階段之研究 European IRPA 對歐洲各地之輻射防護組織進行大量之輻防新觀念推廣宣導，2 年間共舉辦大大小小研討會或講習訓練約 50 場，期以此建立各國之基礎輻防觀念，以利後續政策推動。而第二階段研究，IRPA 對全球 22 個國家進行大規模問卷調查，問卷內容分四部分：

1. 請各國定義其眼球水晶體等價劑量評估及監測方式，並說明其結果分析方法。
2. 請各國說明其對於減低眼球水晶體等價劑量所執行的輻射防護方法；包括防護工具、設備以及其執行程序。
3. 請各國廣泛說明將如何修訂眼球水晶體等價劑量限值。
4. 立法及其他相關行政事項。

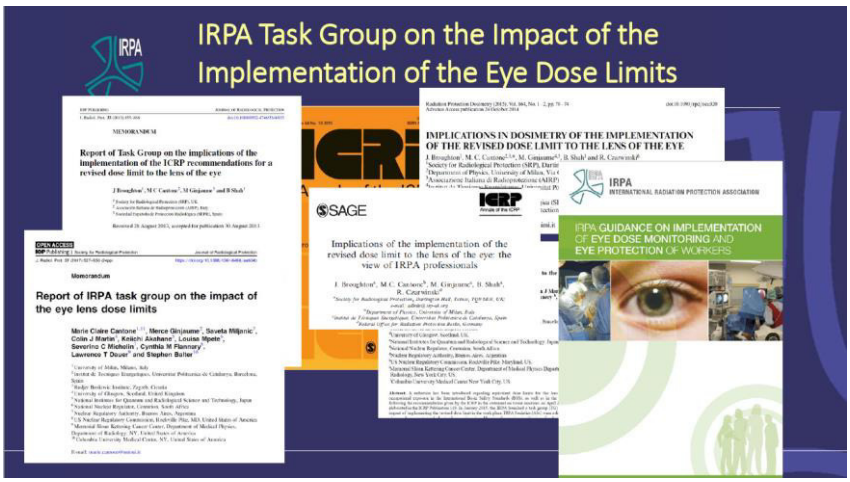

圖 3. IRPA 對於眼球水晶體等價劑量限值修訂之相關研究報告

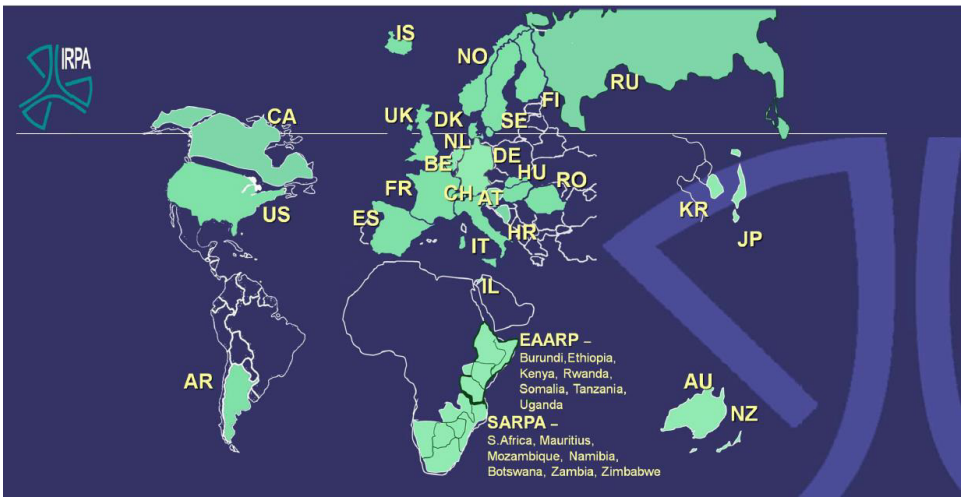

圖 4. IRPA 進行問卷調查之國家分佈圖

IRPA 對歐洲 22 個國家進行問券調查結果顯示，大部分各國目前皆只針對醫療業務非均勻輻射場（如介入性血管攝影及心導管或 CT 影像導引治療技術等）作眼球水晶體等價劑量執行相關行動，行動內容廣泛包含落實或正在規劃執行個別眼球水晶體等價劑量監測、落實或正在規劃強制使用眼球水晶體輻射防護護具、建立眼球水晶體等價劑量計讀及管理系統以及輻防觀念教育訓練宣導等等。另外、也有部分國家藉由這次修改劑量限值的機會，同時調查了關以 Hp(3)作為眼球水晶體等價劑量的評估參數比較適用於飛行員之研究。

而 European IRPA 綜合考量問卷調查結果及歐洲各國對 ICRP103 建議所進行之研究結果，於 2017 年初公告眼球水晶體等價劑量監測及其輻射防護指引書；內容包括眼球水晶體等價劑量監測系統之發展以及適用限制、目前歐洲對於眼球水晶體等價劑量下修之前置作業及行政規劃、以及其他各國對於輻射防護新措施之說明。

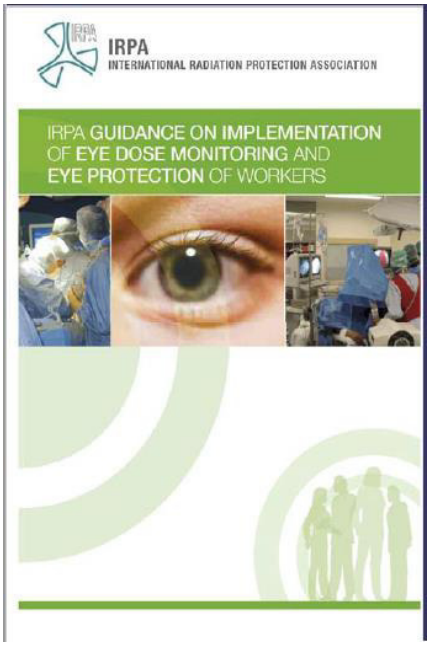

圖 5. IRPA Guidance for eye dose monitoring and protection

IRPA Guidance 對使用眼球水晶體等價劑量監測及輻射防護相關建議

1. 監測設備(眼球水晶體等價劑量計)

眼球水晶體等價劑量監測需要使用頭帶以將劑量計固定於頭部兩側、眉間或額頭；另一方式可將劑量計直接附設在鉛防護眼鏡中，配帶時同時起保護及劑量監測作用。

歐洲目前有一大型之輻射劑量監測研究組織 The European Radiation Dosimetry Group(EURADOS)，其包含 70 個來自歐洲各國之輻射監測研究單位組織、共 570 專家進行各項研究項目。EURADOS 主要目標為統一輻射監測儀器標準，並針對輻射監測計讀建立或協調得可供各國依循的一致做法。EURADOS 於 2018 年 2 月於葡萄牙里斯本舉辦年度會議，並發表了歐洲多種眼球水晶體等價劑量計之監測結果比對研究結果；並提出組織將於 2019 年發表有關依據 IOS17025 規定建立劑量計讀標準實驗室指引書。

圖 6. The European Radiation Dosimetry Group(EURADOS)

圖 7. 法國廠商 IRSN 所研發之眼球水晶體劑量計

圖 8. 由 15 個不同國家所研發之針對光子輻射監測眼球水晶體劑量計

(EURADOS IC2014eye)

圖 9. 由 12 個不同國家所研發之針對光子與電子輻射監測眼球水晶體劑量計(EURADOS IC2016eye)

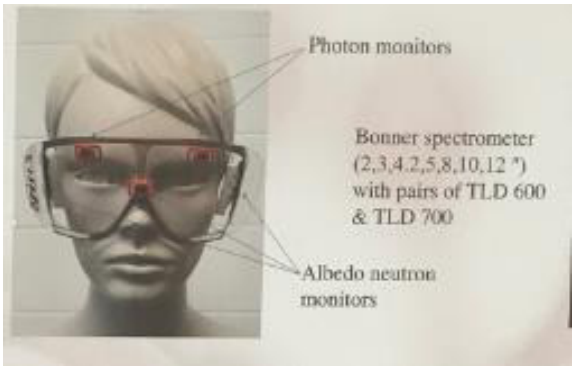

圖 10. 斯洛伐克共和國斯洛伐克醫科大學所研究針對核設施研發之眼球水晶體劑量計(含 2 個光子劑量計及 3 個中子劑量計)，劑量計直接附設在鉛防護眼鏡中，配帶時同時起保護及劑量監測作用。

2015-2017 年所進行問卷調查結果當中，部分國家以傳統劑量佩章佩戴於衣領並配合校正因子以監測 Hp(0.3)，IRPA 於本指引書中明確指出，目前未有相關研究完整發展出適用之能量、方向、角度、距離等校正因子；故此量測方式僅可用於初步鑑別輻射工作人員所受劑量群組，而不適用於眼球水晶體等價劑量監測。

2. IRPA Guidance 輻射防護相關建議

I. 宇航員、計劃曝露(緊急曝露)人員之眼球水晶體等價劑量監測，需額外考量中子及重粒子；而類別 A 輻射工作人員則應監測體外光子及電子輻射。

II. 建議醫療院所(幾乎從事介入性血管攝影及心導管或 CT 影像導引診療之

醫事人員皆被列為類別 A）針對院內業務的相關資料進行紀錄分析，內容應包含院內輻射工作人員種類、曝露量、診療疾病類別、輻射場所相關資料、人員所擔任工作、工作量、臨床執行之透視程序等等，皆需被紀錄，以供院內輻防人員評估參考。

III. IRPA 廣義建議處於下列 2 種輻射作業場所下工作之人員，需進行眼球水晶體等價劑量個別監測：1.非均勻弱穿輻射場；2.輻射從人員前方入射且能量大於 700keV 之電子輻射場。

IV. IRPA 建議所有從事輻射作業人員都皆需接受一年或以上之眼球水晶體等價劑量評估，以年度劑量結果分類不同層次輻射工作人員所受劑量群組（類別Ａ、Ｂ、Ｃ等），以接受不同程度之劑量監控。

建議當年度監測結果等價劑量為 1-6mSv 或每月等價劑量為 0.2-0.5mSv；上述人員之雇主應視情況提供個別監測以確保輻射安全。但法規不要求。年度等劑量大於 6mSv 或每月等價劑量大於 0.5mSv 此群組必須執行眼球水晶體等價劑量個別監測。而當眼球水晶體等價劑量監測得 3-6mSv，建議除應執行個別監測外，應視情況使用適當之輻射防護護具，例如天花板懸掛式輻射防護簾、鉛眼鏡。另、年度等價劑量監測結果大於 6mSv，輻射防護更顯重要，需由政府規定人員於輻射工作期間必須使用輻防護具；天花板懸掛式輻射防護簾、鉛眼鏡等須擇一使用。

3. IRPA 對立法前期作業建議

I. IRPA 表示參與調查之 22 個國家當中，僅少數國家針對該國輻射業務進行調查研究而分類出輻射工作人員所受劑量群組(英國、荷蘭、比利時、德國等等)；多數國家皆以鄰國經驗或文獻參考而定只針對醫療業務非均勻輻射場（如介入性血管攝影及心導管或 CT 影像導引治療技術等）作眼球水晶體等價劑量監測。而會議中提及國家輻射工作人員所受劑量群組分類調查對後續立法依據重要，舉例來說荷蘭與德國調查結果比較，荷蘭因核子工業發展蓬勃，故分類為類別 A 之輻射工作人員包括核廢料處理作業人員、非破壞檢測作業人員及從事醫療業務且執行透

視或 CT 導引介入性診療、核子醫學科診療人員等等；而德國即只有透視攝影診斷醫療人員被列為類別 A；以上例子說明，不同國家，不同政策皆會影響屬於類別 A 之輻射工作人員數量(群組)，為避免浪費社會資源進行額外行政劑量監控，同時取得依據用於立法時排除無須眼球水晶體等價劑量監測之輻射工作人員群組，執行各自國家內部研究調查具其重要性。

（IRPA 指出醫療業務中，執行核子醫學用同位素及合成放射性藥物工作人員，因其在 ICRP 建議下修眼球水晶體等價劑量前已有使用防護面具、手套箱、輸送系統（機械手臂）等等防護措施，故可預期其眼球水晶體等價劑量不會因為法規劑量限值修改而有太大變化。）

II. 需建立合法的行政監控程序以避免輻射工作人員眼球水晶體等價劑量超過限值。目前大部分歐洲國家尚未完整建立行政監控程序，但已進行國家立法，其應對措施大部分使用法規緩衝期方式（設置落日條款），緩衝時間由 3 年到 20 年不等。

III. 研發更適用之眼球水晶體等價劑量參數。各國目前皆以 Hp(3)作為眼球水晶體劑量參數，但對於 Hp(3)是否過於保守代表眼球水晶體等價劑量，歐洲仍持續進行相關研究。

IV. 建立國家行政管理制度以確定市場上已具備：

1.有效監測之眼球水晶體等價劑量計和完善的劑量計讀系統。

2.發展完備的劑量紀錄及分享系統。

V. 國家立法修訂眼球水晶體等價劑量將造成業者額外的經濟成本；購置防護護具、提供劑量監測、辦理輻防訓練等等，各種額外成本支出將使業者強烈反彈，造成新法規推行之阻力；故、明確將輻射工作人員分類管理對新輻防法規之順利推動影響尤甚。政府主管機關應於行政標準中明確訂定各輻射工作人員類別之劑量監測準則及對應須執行之輻防措施，同時設定眼球水晶體等價劑量監控測豁免標準，以降低法規推行之阻力。

VI. 應持續研發方便使用及佩帶舒適之眼球水晶體輻防護具，以增加工作人員長時間使用之意願，同時也能有效減少輻射職業傷害。

VII. 應於法規實施前，針對各類別輻射工作人員建立完整的教育訓練系統，並成立專業團體進行大量宣導作業，以傳播正確輻防觀念。

VIII. 需建立 international Dose Passport 系統，針對經常跨國進行輻射作業之人員進行完整的劑量監控，以確保其輻射安全。

IX. 國家於眼球水晶體等價劑量限值立法後，應投入資源以精進其監測及紀錄方式、並建立輻射防護程序以減少工作人員所接受之等價劑量。

目前大多數歐洲國家已將劑量限值法規修正啟動咨詢過程與立法程序，但尚未完成正式法案公告；而相關行政程序書（指引標準）更只處於內容商議階段；故現況為大部分歐盟國家未訂定行規範，國家境內、不同組織、不同地區、甚至不同醫療院所皆有不同的眼球水晶體監測做法，此情況對主管機關之行政管理將造成一大阻礙。另外，IRPA 表示，目前多數國家以參考文獻或鄰國調查資料訂定輻射工作人員類別，以利於 BSS 所定之期限內完成立法；但各國皆如火如荼進行國內人員類別劃分之調查研究，且積極研發便利又準確之眼球水晶體監控系統。

IRPA 持續對各國法規、輻防作業之執行情況進行調查；並於 2022 年 5 月在韓國漢城辦 IRPA15 中分享各國經驗及工作小組研究結果。

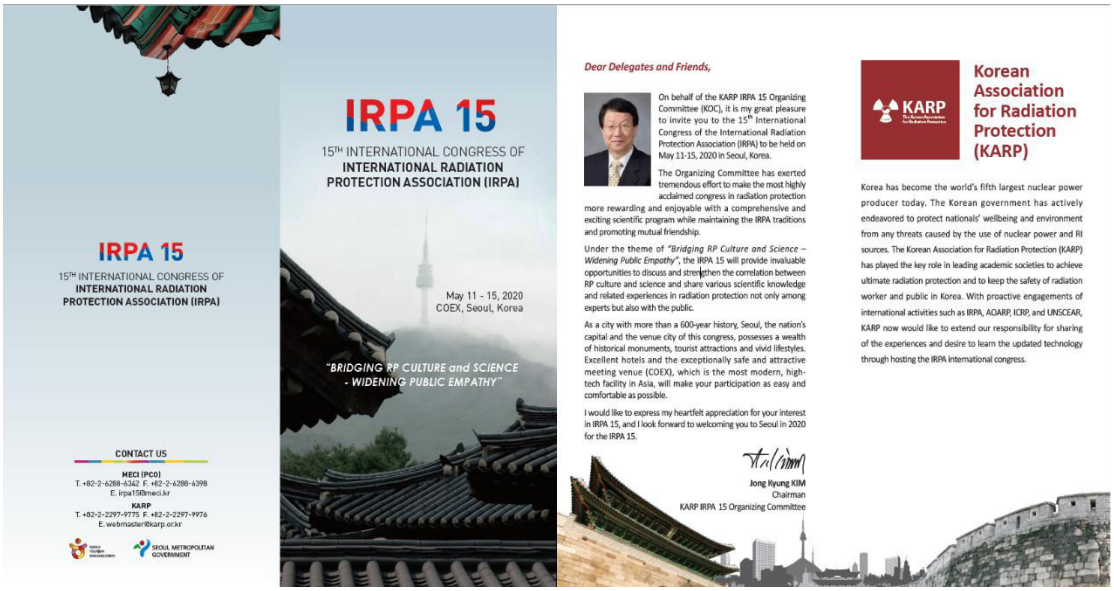

圖 11. IRPA15 簡章

三、 歐洲國家針對眼球水晶體等價劑量下修立法前置作業

荷蘭、比利時

由 NCS(The Nederlandse Commissie voor Stralingsdosimetrie，Netherlands Commission on Radiation Dosimetry）主席講述有關荷蘭與比利時兩國自 2013 年 European BSS 公告歐盟需於 2018 年將眼球水晶體等價劑量限度從每年 150mSv 下修至 20mSv 起，所進行的修法前準備事項及調查。

圖 12. The Nederlandse Commissie voor Stralingsdosimetrie（NCS），Netherlands Commission on Radiation Dosimetry

NCS 於 2016 年 6 月 14 日與比利時輻射防護機構共同成立眼球水晶體等價劑量委員會（Eye lens committee）進行大規模的調查研究，依據研究結果進行輻射工作人員類別劃分；並提出一份眼球水晶體等價劑量監控指引文件（經詢問此指引書目前只有荷蘭語版本），內容包含：

1. 眼球水晶體輻射防護。
2. 眼球水晶體等價劑量監測建議。
3. 需執行個別眼球水晶體監測的情況。
4. 修法時的相關需求。
5. 國際做法及建議。

NCS 規劃這一系列調查研究前，針對 EU BSS art. 41 的論述進行探討；其認為 EU BSS 的論述方式過於模糊，而在行政執法上需被確實量化或另外解釋。原文所示如下：

EU BSS art. 41: When category A workers are liable to receive a significant exposure of the lens of the eye, an adequate system for monitoring shall be set up to ensure that the dose remains under the dose limit.

當類別 A 之輻射工作人員眼球水晶體容易接受到大量輻射曝露時，應建立適當的監測系統，以確保眼球水晶體等價劑量不超過劑量限值。

NCS 認為 EU BSS 所述之「輻射劑量」應包括計劃曝露及意外曝露；另，「接受大量輻射曝露」此量應被明確量化，NCS 建議可視情況訂定，而此值應小於或等於 15mSv。

NCS 建議做法：當輻射工作人員的每單一年眼球水晶體等價劑量可能接受 15mSv 時，應給予個別眼球水晶體等價劑量監測，以確保不超過劑量限制值。唯完備的劑量計讀系統（監測系統）卻不易建立；其需考慮的因素繁多，曝露情況、曝露輻射場均勻度、射束品質、距離等等各種因素皆影響劑量計讀結果及其修正方法； NCS 目前仍致力研發此監測系統。

NCS 為鑑別輻射工作人員所受劑量群組，針對 6 種輻射工作人員進行所受年劑量研究調查：

1. 執行介入性放射診療之輻射工作人員。
2. 執行核子醫學用藥品製造或合成之輻射工作人員。
3. 從事工業用放射照相人員。
4. 進行動物攝影之輻射工作人員。
5. 核子工業輻射工作人員。
6. 同位素生產人員。

圖 13. NCS 研究其每年所受輻射劑量之 6 種輻射工作人員

NCS 對此 6 大類別之輻射工作人員進行為期一年特別輻射測量，實測方式為請人員從事輻射作業期間於衣領上額外佩帶一枚傳統劑量佩章，且每月落實劑量計讀並紀錄之。（其中僅從事工業用放射照相人員劑量佩章佩帶於胸前。）計讀數值為 Hp（0.07）和 Hp（10）【非計讀 Hp（3）】，NCS 希望以實測方式將個人劑量有可能大於 15mSv 的輻射工作人員初步進行分類。結果顯

示，6 種分類中僅以從事介入性放射診療之輻射工作人員，其年劑量有可能超過 15mSv。故 NCS 建議就成本效益、政策執行的各方面考量，提出只需針對從事介入性放射診療之輻射工作人員執行眼球水晶體等價劑量個別監測即可，無須大規模要求各界從業人員投資成本進行監控及紀錄管理。

NCS 強調本次調查基於時間與成本因素，使用劑量佩章佩戴於衣領讀得之方式進行研究，結果僅適用於初步分類輻射工作人員類別，並不能代表人員真正眼球水晶體等價劑量，正確眼球水晶體等價劑量正確量測需使用特別的劑量計以及計讀系統。NCS 規劃於 2018－2019 將針對眼球水晶體等價劑量以及肢端劑量，使用眼球水晶體劑量計及指環劑量計執行更進一步之人員所受劑量調查研究，期將研究結果供主管機關訂定行政標準參考；以明確訂定需執行個人輻射監控的類別及其輻射監控程度（意即那類人員應只執行 Hp（10）監測、或 Hp（10）加上 Hp（0.07）監測，又或 Hp（10）、Hp（0.07）及 Hp（3）三者同時監測等等，以及其各自的計讀頻率）。

另外 NRC 建議應規定雇主提供輻射工作人員每 2 年一次視力檢查；每 5 或 10 年一次眼睛健康檢查。而我國則規定每年游離輻射工作人員特殊健康檢查內容皆包含此兩項檢查。

法國

加泰隆尼亞理工大學(位於法國巴塞隆納)研究結果建議：

研究根據英國衛生安全署 HSE(UK)於 2015 年對 8511 名輻射工作人員進行眼球水晶體等價劑量調查結果所示；517 名人員(其中 12 名從事醫療業務)每年所受眼球水晶體等價劑量為 3-15 mSv，5 名(其中 1 名從事醫療業務)人員劑量為 15-30 mSv，1 名從事醫療業務人員劑量大於 30 mSv。8511 名人員劑量調查共有 523 名人員 Hp（3）結果大於 3mSv；其中 14 名從事醫療業務人員，其他 509 名人員多為從事核設施除役相關作業人員。另外，英國 HSE 在這次調查中也針對

12670 名人員進行肢端劑量調查，發現其中劑量大於 150 mSv 共 9 名（7 名從事輻射醫療業務），大於 500 mSv 有 1 名。加泰隆尼亞理工大學依據上述 HSE 資調查料、法國歷年有關劑量統計結果以及 IAEA TecDoc1731（2013）及 Annex ISO 15382（2015）建議，總括了 4 類輻射工作人員需要進行個別監測眼球水晶體 Hp（3）及肢端劑量 Hp（0.07）：

1. 從事醫療業務輻射工作人員。（針對透視或 CT 導引介入性診療、核醫科人員、迴旋加速器作業人員）
2. 核設施人員（核設施除役相關人員）
3. 非破壞檢測作業人員。
4. 執行緊急計劃曝露輻射工作人員。

圖 14. 英國衛生安全署（HSE）

【IAEA TecDoc1731（2013）及 Annex ISO 15382（2015）內容簡介】

對於光子輻射場防護建議：

1. 光子平均能量若大於 40keV 應執行個別人員劑量監測，包括 Hp（0.07）和 Hp （10）。而小於 40keV 則應考量輻射入射方向；當輻射由人員正前方入輻射，則應執行個別人員 Hp（10）和 Hp（0.07）之監測，否則只需監測輻射射入人員方向之 Hp（0.07）。

2. 若環境為非均勻輻射場，除 Hp（10）及 Hp（0.07）外，需額外進行 Hp（3）監控，以確保輻射工作人員劑量所接受劑量沒有超過限值。

而對於電子輻射場防護建議：

1. 電子最大能量若小於 0.7MeV，則無須進行 Hp（3）監測，因此能量電子無法穿到水晶體而使其得到劑量。
2. 若環境為非均勻輻射場且電子最大能量大於 0.7MeV，則應同時執行個人 Hp（10）、Hp（0.07）以及 Hp（3）監控，以確保人員輻射安全。

Impact factor	**Comment**	
A (Energy and angle)	Is the maximum beta energy above about 0.7 MeV?	
	If no ↓ No monitoring due to beta radiation is necessary as it does not penetrate to the lens of the eye.	If yes ↓ Monitoring is necessary as described in lines B and C.
B (Geometry)	As beta radiation fields are usually rather inhomogeneous, monitoring of the dose to the lens of the eye is necessary with the dosimeter placed near the eyes. However, it may not be needed if a thick enough shield is used, see impact factor C.	
C (Protective equipment)	Is protective equipment such as shields and glasses that are thick enough to absorb the beta radiation in use?	
	If used for the eye ↓ Consider 'photon radiation' as the beta radiation is completely absorbed in the shielding; however, bremsstrahlung has to be taken into account — the contributions from both that produced outside and that produced inside the shielding.	If not used ↓ $H_p(3)$ is the only appropriate quantity.

圖 15. ISO 15382 對光子輻射場防護建議說明圖

<table>
<tr><th>Impact factor</th><th colspan="3">Comment</th></tr>
<tr><td rowspan="3">A
(Energy and angle)</td><td colspan="3">Is the mean photon energy below about 40 keV?</td></tr>
<tr><td>If yes
↓
$H_p(0.07)$ may be used but not $H_p(10)$
(see Fig. 6 in Ref. [65] and Fig. 1 in Ref. [66])</td><td colspan="2">If no
↓
Is the radiation coming mainly from the front or is the person moving in the radiation field?</td></tr>
<tr><td>If yes
↓
$H_p(0.07)$ or $H_p(10)$ may be used
(see Fig. 1 in Ref. [66])</td><td>If no
↓
$H_p(0.07)$ may be used but not $H_p(10)$
(see Fig. 1 in Ref. [66])</td></tr>
<tr><td rowspan="2">B
(Geometry)</td><td colspan="3">Are homogeneous radiation fields present?</td></tr>
<tr><td>If yes
↓
Monitoring on the trunk may be used.</td><td colspan="2">If no
↓
Monitoring near the eyes is necessary.</td></tr>
<tr><td rowspan="2">C
(Protective equipment)</td><td colspan="3">Is protective equipment such as lead glasses, ceiling, table shields, and lateral suspended shields in use?</td></tr>
<tr><td>If used for the eye
↓
Monitoring near the eyes and below the protective equipment or below an equivalent layer of material is necessary. Otherwise, appropriate correction factors to take the shielding into account should be applied.</td><td colspan="2">If used for the trunk (e.g. a lead apron)
↓
Monitoring below the shielding underestimates the dose to the lens of the eye as the eye is not covered by the trunk shielding.
↓
Separate monitoring near the eyes is necessary.</td></tr>
</table>

圖 16. ISO 15382 對電子輻射場防護建議說明圖

加泰隆尼亞理工大學研究認為此 4 類工作人員有可能達 ICRP 所定義類別 A 之標準，故建議法國政府應同時考量 4 類人員所受輻射種類、能量、輻射場特性等相關因素，規劃各類型人員應接受之輻射劑量監測項目及監控程度，以免浪費社會資源。另考量成本效益及行政執行等問題，研究報告亦建議政府可採取每季監控的方式進行，即因業務內容而被要求額外佩帶之劑量計（眼球水晶

體劑量計及肢端劑量計）無須每月計讀監測，每 3 個月計讀 1 次即可；如此既可達劑量監控目的，同時可減少業者因成本增加而引起反彈。

加泰隆尼亞理工大學報告強調，上述 4 類輻射從業人員僅為參考英國調查結果及相關文獻所定，並不能完全代表法國國內輻射作業人員所受劑量之情況，故建議仍需進行國內劑量調查研究，以確定需額外接受眼球水晶體劑量監測之人員類別。

參、　　心得與建議：

本次 5th European IRPA Congress 會議中，約 20 場課程內容為分享歐國家對眼球水晶體劑量修訂之做法，歸納三重點；

（1） 對於 2013 年 European BSS 公告歐盟會員國需於 2018 年將眼球水晶體等價劑量限度從每年 150mSv 下修至 20mSv，大部分國家目前立法程序已經進入最後國會審議階段，但因行政執行及教育推廣等相關問題，以致於各國法規多設有緩衝期限，期限由 3 年至 20 年不等。

（2） 歐洲各國政府對設定應接受個人有效劑量、眼球水晶體及肢端劑量監控之輻射工作人員群組，應確實進行國內調查研究，避免進行多餘的劑量監控，浪費社會資源。另外，調查結果可供政府後期訂定行政標準所用，數據可以作為排除無須接受眼球水晶體等價劑量監控群體之佐證資料，以免日後法規推動之爭議。會議中 NCS 人員亦口述表示，進行國內輻射工作人員分類調查需大量資金及行政資源，目前歐洲僅較大型國家願意投入成本進行調查；小型國家仍依據或參考國情相仿的國家之做法；雖未能正確評估實況，但對小型國家而言卻為一可取方法。

（3） 法規修訂前應建立行政管理制度以確定市場上已具備有效監測之眼球水晶體等價劑量計及完善的劑量計讀系統，且發展完備的劑量紀錄及分享系統。

（4） 歐洲各國職業安全管理制度，除以法規規範劑量限值，另有一套由政府公告之執行建議（指南），其內容建議業者相關劑量監控方式，計讀標準，輻防措施以及相關場所安全規範等等；而此執行建議書須由政府公告但未強制規定業者必須比照辦理；設施經營者仍需於執業前依其設施規模，輻射作業內容等情況全面評估，並訂出人員劑量管控計畫書，經主管機關審核後始得進行相關作業。依照上述管理概念，設施經營者需依不同之作業內容規劃不同之管控計劃書，如輻射工作人員劑量管控計劃書，輻射工作人員職業傷害管控計劃書，放射性污染物管控計劃書，

環境定期偵測管控計劃書……而各項計劃書皆需經相關政府部門核可。

（5） 以上行政規劃皆可供我國法規修訂之參考應用。另建議應持續派員出國參與相關會議，持續了瞭解國際對於輻防管制之行政程序以及劑量監測系統之發展，以利我國輻防法規精進並順利與國際接軌。

肆、　附錄

附件 1、5th European IRPA Congress 會議簡章

附件 2、法國 IRSN 公司眼球水晶體劑量計資料

附件 3、德國 Radpro 公司眼球水晶體劑量計資料

IRPA 2018

NVS

5th European IRPA Congress
4 - 8 June 2018
The Hague, The Netherlands

Encouraging Sustainability in Radiation Protection

SUSTAINABILITY IN RADIATION PROTECTION

DEVELOPMENTS IN MEDICAL APPLICATIONS

SECURITY AND EMERGENCY PREPAREDNESS

March 2017

SECOND ANNOUNCEMENT

CONTENTS

WELCOME MESSAGE FROM THE CONGRESS PRESIDENT

The 5th European IRPA Congress is scheduled to take place from 4 to 8 June 2018 in the city of The Hague, The Netherlands and will be hosted by the Dutch Society for Radiation Protection (NVS).

With the theme "Encouraging Sustainability in Radiation Protection", the Congress will focus on the various aspects needed to make sure that we have, and will continue to have, adequate equipment, staff and resources to protect human health and our environment adequately against the adverse effects of ionising and non-ionising radiation. Consequently, activities for and by the younger generation of Radiation Protection professionals are strongly supported.

We are happy to inform you that many Associate Societies actively participate in the Scientific Programme or Organising Committee. We owe the members of these committees many thanks for establishing an outstanding programme, with high quality scientific sessions, refreshers and technical visits. The five day programme of the Congress will offer you a whole range of plenary, parallel and poster sessions on all relevant scientific and operational topics in radiation protection, as well as plenty of opportunities for exhibitors.

With digital poster sessions including pitches, extended refresher sessions, technical visits which are partially combined with refreshers and various sessions (not exclusively) dedicated to young radiation protection professionals, our Congress will show a clear evolution in the series of IRPA Congresses. Most importantly, the Congress offers radiation protection professionals the opportunity to interact and exchange experiences among each other. Thus we are confident to contribute to realizing what is expressed by the theme of our Congress.

I really do hope that you will be able to disseminate the 2nd announcement of this Congress as widely as possible and that you will also be able to contribute to the success of the 5th European IRPA Congress by submitting your abstract and attending the Congress. Of course I also would like you to take advantage of this opportunity to visit our beautiful country and, in particular, our residence, The Hague. I'm looking forward to welcome you in June 2018!

Hielke Freerk Boersma
Congress President
NVS Board Member Congress Affairs

INTERNATIONAL RADIATION PROTECTION ASSOCIATION (IRPA)

IRPA is the international society for radiation protection with as main purpose to provide a medium whereby those engaged in radiation protection can easily communicate with each other and through this process improve radiation protection in many parts of the world. This includes branches of knowledge such as science, medicine, engineering, technology and legislation, to protect mankind and its environment against the hazards caused by ionising radiation, and thereby implicitly facilitating the safe application of medical, scientific, and industrial radiological practices for the benefit of mankind.

IRPA comprises about 18000 individual members representing 52 national and regional societies in 67 countries. Through these associate societies, benchmarks of good practice are provided and professional competence and networking is enhanced.

One of the major tasks for IRPA is to provide and support international (regional) meetings for the discussion of radiation protection. Ever since 1966 international Congresses have been organised for radiation protection practitioners to gather and exchange achievements, scientific knowledge and operational experience in radiation protection.

ABOUT YOUR HOST

The Dutch Society for Radiation Protection (NVS) invites you to join the 5th European IRPA Congress, which will take place in The Hague, The Netherlands from 4 to 8 June 2018.

NVS was founded more than 55 years ago, in 1960, as a scientific society to enhance knowledge of radiation protection in medicine, industry and research. Today the society is recognized as the professional society for radiation protection professionals. Our aim is to promote the professional development of our members through scientific conferences, thematic groups, our four-monthly journal, refresher courses and our website. In order to encourage young professionals in radiation protection the society awards the Joh Aten Grant, to be used for participation in IRPA Congresses.

NVS recognizes the importance of providing means for members to learn from each other on a national and international scale. We therefore promote the involvement of our members in national, European and international activities such as workshops, committees and conferences. After being your host for the sub-regional Congresses in 1975 (Amsterdam) and 2003 (Utrecht) we are honored to be your host again and hope you will be attending the 5th regional IRPA Congress in The Hague. With the theme "Encouraging Sustainability in Radiation Protection" the Congress aims to focus on the challenges of maintaining high professional standards and ensuring adequate resources in radiation protection in a rapidly changing world. I hope you will be able to actively participate in the Congress and share your knowledge.

Carolien Leijen
President Dutch Society for
Radiation Protection (NVS)

CONGRESS OVERVIEW

The basis for the scientific programme is the Congress Theme: Encouraging Sustainability in Radiation Protection.

The Congress will focus on aspects needed to make sure that we have, and will continue to have, adequate equipment, staff and resources to protect human health and our environment against the adverse effects of ionising and non-ionising radiation.

ORGANISATION

Steering committee

From left to right:
Bert Gerritsen, Jan Kops, Lars Roobol, Hielke Freerk Boersma, Anita Buiteman, Gert Jonkers, Carel Thijssen

Scientific Programme Committee

Lars Roobol	Chair SPC/NVS
Adrie Bos	NVS
Alexander Brandl	ÖVS
Alexander Samoylov	SRG Russia
Anita Buiteman	A Solution Events
António Miguel Morgad	SPPCR
Arjen Becht	NVS
Barbara Godthelp	NVS
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Christoph Stettner	ÖVS
Constantin Milu	SRRP
Cyril Schandorf	GARP
Daniela Ekendahl	CSRP
Eric van Rongen	Section NIS
Folkert Draaisma	EUTERP/NVS
Francesco Mancini	AIRP
Frank Jungbauer	NVS
Gert Jonkers	NVS
Gordana Pantelic	SRPS&M
Graciano Paulo	SPPCR
Harry Slaper	NVS
Helen Day	SRP
Hielke Freerk Boersma	NVS
Jean Koch	ISRP

Jean-Paul Samain	BVS/ABR
Jennifer Humphries	SRP
Jörg Feinhals	FS
Joseph K. Amoako	GARP
Kamil Szewczak	PTFM
Katharine Thomson	SRP
Klaus Henrichs	IRPA
Ladislav Tomásek	CSRP
Leo van Velzen	NVS
Lorraine Currivan	IRRS
Marcel Greuter	NVS
Marie Claire Cantone	IRPA/AIRP
Mercé Ginjaume	SEPR
Michael Hajek	ÖVS
Michal Gryzinski	PTFM
Michèle Coeck	EUTERP/BVS
Paul van Rooijen	NVS
Pedro Vaz	SPPCR
Peter de Jong	NVS
Richard Paynter	EUTERP/SRP
Rob Coppes	NVS
Ronald Smetsers	Co-chair SPC/NVS
Sébastien Point	SFRP
Sergey Shinkarev	SRG Russia
Sija Geers	NVS
Sofía Luque	SERP
Stephen Inkoom	GARP
Tom Grimbergen	NVS
Ton Vermeulen	NVS
Tuuka Turtiainen	NSFS
Valérie Chambrette	SFRP
Yuri Franken	NVS
Zeljka Knezevic Medija	CRPA

Local Organising Committee

Jan Kops
Hielke Freerk Boersma
Anita Buiteman
Bert Gerritsen
Trude van der Heijden
Peter de Lange
Linda Janssen-Pinkse
Gert Jonkers
Wout Moerman
Carel Thijssen
Ton Vermeulen
Bas Vianen
Jeroen Welbergen
Rob Wiegers

CONGRESS PROGRAMME

The basis for the scientific programme is the Congress Theme: Encouraging Sustainability in Radiation Protection
The Congress will focus on aspects needed to make sure that we have, and will continue to have, adequate equipment, staff and resources to protect human health and our environment against the adverse effects of ionising and non-ionising radiation.

Therefore, the programme guarantees sufficient time/space to share practical and theoretical knowledge, highlight new challenges and how to handle these optimally at all times with the sustainability in radiation protection in focus. The programme will address five major areas in radiation protection:

5 MAIN TOPICS FOR IRPA 2018

Fundamental and/or General Issues

» Sustainability in Radiation Protection; Security of sources, installations and plants; Fundamental safety and security objectives and principles of protection, safety and security, and education and training herein; Emergency preparedness; etc.

Medical

» All radiation protection activities and issues related to the safe, secure and economic use of radioisotopes and X-rays in health care applications, including education and training; etc.

Industry

» Operational radiation protection practices at e.g. NPP's; Waste storage/disposal facilities for artificial nuclides as well as for NORM; Reprocessing plants; Decommisioning projects; etc.

Research and Applications

» R&D, licensing, construction, operation, effect on people and environment; Regulatory/public acceptance and radiation protection aspects of (new) developed isotopes and applications for medical and industrial use; etc.

Non-ionising Radiation

» UV-radiation protection and UV health effects, skin cancer prevention, balancing UV health hazards and benefits; Solar and artificial UV-exposures in environmental, medical, cosmetical and industrial situations for public, patients and workers; LASER safety and protection in medicine and industry; Electro-Magnetic Fields; etc.

Within each area, the following subspecialties have been defined:

1. Regulations & Legislation
2. Education & Training
3. Security & Emergency Preparedness
4. Occupational-, medical- & public exposure
5. Communication
6. Stakeholder Involvement
7. Risk Management
8. Physics; Chemistry; Biology (e.g. effect of ionising and non-ionising radiation on man and environment)
9. Decommissioning
10. Environmental Remediation
11. Waste Management
12. Miscellaneous

Sessions

The programme will feature a series of keynote plenary presentation sessions, parallel topical sessions, poster sessions, plenary summaries, and provide focused forums.

The plenary sessions, featuring world-leading radiation scientists and radiation protection practitioners, will highlight the current state of key topics. The final plenary session will identify the principal conclusions and outcomes from the Congress, highlighting the role and activities of IRPA.

Some 40 topical sessions, organised in groups of five parallel sessions, will provide oral presentations of submitted papers and selected keynote presentations, reflecting the scientific and practical areas defined by the topics and subjects specified above.

Posters

There will be digital poster boards and participants can seek contact with authors through the Congress app to make appointments for poster discussion and analysis. Also, in the schedule, there will be time slots where authors can bring their posters to the attention in a short pitch.

Refresher courses

The Refresher Course programme provides participants with the opportunity to update their knowledge in specific areas of radiation protection science and practice. The courses are aimed at providing a broad overview of the current state of a given topic, thereby giving participants not working directly in that field a sound understanding of the current status, and at giving experienced practitioners a more detailed understanding of up-to-date developments in a field.

In our preliminary schedule, we have arranged for 27 refresher courses to be held, on Monday and Wednesday. The first courses will start at 8.30 a.m. and will be offered in four parallel sessions. The courses will be delivered by selected instructors according to their outstanding expertise and competence in teaching. Some will be at the beginner level, some at a more advanced level, and some courses will be aimed at young professionals.

Course details will be available to facilitate accreditation by Associate Societies or National Regulatory Bodies for relevant Continuing Professional Development (or equivalent) schemes.

There will be NO EXTRA FEE for the refresher courses. However, registration for the refreshers is obligatory. The list presents outline information on the course schedule; the latest course details will be specified on the Congress website and will be clearly indicated in the registration system.

REFRESHER COURSES

The following courses have been preliminary scheduled:
(definitive titles will be communicated through the IRPA2018 website)

Monday 08.30
RC1 Young Professionals 1
RC2 Patient Dose Management Software
RC3 Security 1
RC4 NORM 1

Monday 09.45
RC5 Young Professionals 2
RC6 Protection of Lens, Skin & Extremities
RC7 Security 2
RC8 NORM 2

Monday 11.00
RC9 Young Professionals 3 – Discussion/Workshop
RC10 Computational Dosimetry
RC11 Nuclear Industry and Radiation Protection 1
RC12 Radon/Thoron 1

Wednesday 09.00
RC13 Risk Perception & Communication 1
RC14 Non-Ionising Radiation 1
RC15 Nuclear Industry and Radiation Protection 2
RC16 Radon/Thoron 2

Wednesday 10.15
RC17 Risk Perception & Communication 2
RC18 Patient Dosimetry and Computed Tomography 1
RC19 Biological Effects 1
RC20 Decommissioning and Environmental Remediation 1

Wednesday 11.30
RC21 Non-Ionising Radiation 2
RC22 Patient Dosimetry and Computed Tomography 2
RC23 Biological Effects 2
RC24 Environmental Remediation 2

Wednesday 13.30
RC25 Education & Training / EUTERP 1

Wednesday 14.45
RC26 Education & Training / EUTERP 2

Wednesday 16.00
RC27 Education & Training / EUTERP 3

TECHNICAL VISITS

A range of interesting technical visits has already been planned showing the wide range of radiation related applications and aspects of (non-)ionising radiation present in The Netherlands. The visits are scheduled at Wednesday (afternoon) during the Congress. The visits (sign in via the registration form) will only take place, if sufficient participants are signing in. Please note (cf. registration form) there may be a maximum number of participants for a specific visit. Other aspects, such as foreseen combination with refresher courses or additional information on the visits will be published in due time. You will always have the option to change your preferences until May 1st, 2018 in case you prefer another technical visit based on the additional information.

The fee for the technical visits will be € 40 per person per visit. The list below presents outline information on the visits; the latest details will be specified on the Congress website and will be clearly indicated in the registration system.

Currently, the following Technical Visits have been confirmed:

TV1 Research - Nuclear Research Reactor / RID, Delft: reactor and neutron beam lines.
TV2 Research - Outer Space / ESA, Noordwijk: outer space radiation doses.
TV3 Industry - NORM Repository / Reuse Site, Maasvlakte: very low activity / NORM waste.
TV4 Industry - Container Scanning / Customs, Rotterdam Harbour: scans of containers / nuclear detection.
TV5 Medical - Health Care / Philips, Best: medical scanning equipment and non-ionising radiation.
TV6 Industry - Waste Management / COVRA, Vlissingen: (medical) waste management.
TV7 Studie Centrum Kernenergie / Centre d'Étude d'Énergie Nucléaire (SCK/CEN): nuclear energy, radionuclide laboratories, reactor technology, decommissioning and decontamination, waste management.
TV8 Industry - Uranium Enrichment / Urenco, Almelo: uranium enrichment.
TV9 Industry - Geothermal NORM / ECW, Middenmeer: NORM resulting from application of geothermal energy.
TV10 Applied Science - KVI-CART, Groningen: applied nuclear physics, accelerator physics.
TV11 Industry - Application of (Non-)Ionising Radiation: process control by means of X-ray sources and (narrative) on measures to minimize NIR exposure
TV12 Non-Ionising Radiation - Antennebureau, Amersfoort: telecom antennas.

TECHNICAL VISITS - DETAILS

TV1

Reactor Institute Delft/Technical University Delft, Delft (Research & Applications)

The RID operates a unique, small pool-type research reactor that is not built to produce electrical power, but is a source of neutrons and positrons for research purposes. Since 2012 the potential of this reactor is further developed and expanded by the OYSTER (Optimized Yield -for Science, Technology and Education- of Radiation) programme. Within the programme several new scientifically competitive instruments are commissioned, have been built or are planned.

TV2

European Space Research and Technology Centre/European Space Agency – ESTEC/ESA, Noordwijk (Research & Applications)

The European Space Research and Technology Centre (ESTEC) in Noordwijk, The Netherlands, is the largest ESA establishment. ESTEC is a showcase for the Directorate of Human Spaceflight's programmes and missions. Its role is to inform and advise users interested in ESA's space platforms and ground-based facilities. It may be clear that working in space involves enhanced levels or radiation and is therefore an important safety issue. You will be welcomed at ESTEC and after a presentation a tour will be given through the technical heart of ESTEC to give you a deeper view of the life at ESTEC with an emphasis of radiation protection aspects.

TV3

NORM Reuse and Waste Processing, Maasvlakte (Industry – NORM)

At the Maasvlakte site both a repository for NORM wastes is situated as well as reuse for certain types of NORM wastes is carried out on an industrial scale. Part of the technical visit will be an introduction the operations of this site together with some generic insight in the NORM waste options The Netherlands. Next to the introduction a visit to the site will be paid including the immobilisation options and the repository itself.

TV4

Rotterdam Harbour Customs, Rotterdam (Fundamentals & General Issues – security)

Being one of the mainports of the World, Rotterdam has to handle around one quart of all goods entering or leaving the European Union. Cargo that is indicated as riskfull will be scanned with scanners that use linear accelerators and the images are analysed. For safety and security containers go through radiation detection portals to detect the presence of nuclear and radioactive material.

TV5

Royal Philips – Best (Medical)

From a radiation protection point of view Royal Philips is a health technology company producing advanced medical systems from diagnostic imaging to image-guided therapy. The visit will comprise of a presentation on/by Royal Philips as well as a presentation on both ionising and non-ionising radiation aspects involved using these systems. Furthermore, a visit through the manufacturing hall is scheduled.

TV6

Central Organisation for Radioactive Waste – COVRA, Vlissingen (Industry – Medical Waste)

There are many producers of radioactive waste varying from nuclear reactor operators to mineral and-or ore processing industries (NORM). Radioactive waste must be prevented from contaminating our environment. So it is important that the waste is professionally collected, processed and stored. This visit focuses on the peculiarities of radioactive waste from medical isotope production.

TV7

Belgian Nuclear Research Centre – SCK•CEN, Mol (Fundamentals & General Issues)

SCK•CEN is one of the largest research institutions in Belgium. Every day, more than 700 employees dedicate themselves to developing peaceful applications of radioactivity. Main research topics include the safety of nuclear installations, the well-considered management of radioactive waste and human and environmental protection against ionising radiation. In this visit both some lectures on the activities of SCK•CEN will be given as well as some more in depth presentations on waste management. A visit to several (laboratory) facilities as well as the underground laboratory (HADES) is planned.

TV8

URENCO, Almelo (Industry – Nuclear Fuel Cycle)

URENCO exploits ultra centrifuges for the enrichment of uranium and/or the enrichment of stable isotopes of certain elements for medical or industrial use.

TV9

Geothermal Site, Middenmeer, (Industry – NORM)

During heat extraction from well fluids in geothermal energy production unwillingly Naturally Occurring Radioactive Material (NORM - mostly in the form of scale, sludge or material filtered of) is encountered. With a visit to this site the participants will get an impression how a geothermal site is laid out and how the NORM residues are dealt with. A short refresher on geothermal energy production will be provided. We are currently discussing with an Oil and Gas producer to visit a NORM site. Please follow our website to check on new developments on this potential extension of the visit.

TV10

Centre for Advanced Radiation Technology – KVI/CART, Groningen (Research & Applications)

The KVI-CART performs basic research on subatomic and astro-particle physics and application-driven research on accelerator physics and physics in medicine. The cyclotron (1997) is capable of accelerating both light and heavy ions. The centre closely collaborates with the scientific community, healthcare and industry, on long-term solutions for science and society. Through the development of state-of-the-art detection techniques, KVI-CART fosters the cross-fertilisation between basic and application-driven research.

TV11

Tata Steel, Velsen-Noord (Industry – Applications & Non Ionising Radiation)

Tata Steel applies various X-ray and/or radioactive sealed sources for process control (e.g. steel thickness or coating thickness measurements). Next to this strong electro-magnetic fields may exist near e.g. induction furnaces. With a visit to this site the participants may have a view to the application of ionising radiation sources, while protection measures against the hazards of electro-magnetic fields will be elucidated in a presentation.

TV12

Antennebureau, Amersfoort (Non-Ionising Radiation)

The Antennebureau – the information agency of the Dutch government concerning antennas – wil be visited. Various types of telecom antennas will be shown and electromagnetic field c.q. radiation issues will be discussed.

YOUNG PROFESSIONALS

The Organising Committee issues a special invitation and encouragement to younger scientists and professionals to attend the Congress as participants. Besides the Young Professionals Award, the Scientific Program Committee has arranged for a refresher session to be held specifically (but not exclusively) aimed at young professionals.

The purpose of the young professional award is to promote investigation into radiation protection and all its related disciplines by young scientists and professionals. The IRPA Young Professionals Award renders an opportunity to present the work in an oral form to an experienced international audience of experts and peers. These presentations will take place in a separate, plenary session of the Congress.

Rules

To qualify for this distinction young scientists and professionals are required to:

- be under 35 years, or in exceptional cases if the candidate is older, be in the first decade of their career in radiation protection;
- be the main author of a paper whose abstract has been approved by the Scientific Committee or Board of the candidate's Radiation Protection Associate Society in that Region;
- if the work has more than one author, obtain the written consent of the other authors for the main author to be the candidate for the award;
- and be officially designated by the relevant Associate Society in the Region of the Congress.

The Candidate's Associate Society is required to:

- nominate their candidate(s) to the Congress organisers in accordance with the Congress rules. Only one candidate per society is allowed for IRPA2018;
- and ensure that the candidate for the award can participate in the Congress and make an oral presentation of the paper.

Awards

From the young scientists and professionals nominated by their Associate Societies three (first, second and third) award winners will be selected according to criteria established by the Jury. An extra award will be presented to the competitor who's presentation and work is appreciated most by the audience. The awards will be announced and presented in the Closing Ceremony of IRPA2018, and will consist of diplomas and/or memorial plaques. All candidates for the award should be present during this ceremony.

SOCIAL PROGRAMME

Monday June 4th

Welcome Cocktail Reception at the World Forum.
Directly after the first Congress day a cocktail reception will be held for all participants and guests of IRPA-2018. This is an opportunity to meet colleagues and make friends.

Tuesday June 5th up until Thursday June 7th

Early Run through The Hague

On Tuesday, Wednesday and Thursday there will be the opportunity for all participants to join the morning charity run in the nearby Scheveningse Bosjes (Scheveningen Bush).
This run - near and around the World Forum - will provide you with an energy boost for the Congress.

Thursday June 7th

Congress Dinner at Kurhaus The Hague in Scheveningen

The Kurhaus was built between 1884 and 1885. It consisted originally of a concert hall and a hotel with 120 rooms. Several kings and heads of state sojourned in the Kurhaus. Until the 1960s, the Kurhaus remained an attraction to the public via many performances by top artists such as Maria Callas, Yehudi Menuhin, Vladimir Horowitz and Duke Ellington. The last performance in the Kurhauszaal was by the Rolling Stones on 8 August 1964. Fallen into disrepair and closed in 1969, the Kurhaus was saved from demolition in 1975 by being listed as a historic building and completely renovated. It was reopened in 1979 by Queen Beatrix.

CALL FOR ABSTRACTS

The Scientific Programme Committee is pleased to invite participants to submit their contribution to the IRPA2018 European Congress through the online submission system. Once accepted, it will be decided whether your contribution will be presented at IRPA2018 as a poster or as an oral presentation. Your poster, PDF or PowerPoint presentation and your full paper will be made publicly available through the IRPA2018 website after the Congress.

To view the abstract submission page on the website, go to:
www.irpa2018europe.com/registration

The final date for the submission of abstracts is November 1st, 2017.
After submission, abstracts will go through a review process and authors will be notified by February 1st, 2018 whether their submission has been accepted.

Your abstract should summarize clearly the proposed content of the full paper, including any major scientific findings or conclusions. The acceptance of abstracts will be based on their scientific and technical quality and clarity of writing.

The presenting author will be required to register online as a participant. The website will take you through the registration and abstract submission process. If in doubt, please contact the organisers at info@irpa2018europe.com. Once registered, you will receive a confirmation email.

Please refer to the website for more information:
www.irpa2018europe.com

CALL FOR SPONSORS/EXHIBITORS

The treasurer likes to inform you on the options for advertising and promoting your company, your products and/or services at the IRPA2018 European Congress. Anticipating on the attendance of the former four European Congresses more than 700 radiation protection professionals working for hospitals or medical institutes, for radiological research institutes, for industries encountering Naturally Occurring Radioactive Material (NORM), for nuclear power plants, for competent authorities, etc. are expected to participate.

Though a European Congress, attendants from all over the World (more than 20 countries like Japan, Korea, USA, Middle and Far East, etc.) are generally participating. For the main part the attendants are essential radiological stakeholders involved in decision making with respect to the acquirement of radiometric equipment, medical imaging devices, health physics instruments, required NORM services, etc..

Please refer to the website for our sponsor & exhibition prospectus:
www.irpa2018europe.com/sponsors

N.B. Start ups within 5 years of their foundation and small companies with less than 5 employees may negotiate special deals. Please contact the IRPA 2018 Europe Congress Office on this issue, if interested in a sponsoring or exhibition activity.

REGISTRATION

Registration for this Congress can be done via:
www.irpa2018europe.com/registration

Registration Fee

Extra early bird fee *	€ 630	(until September 1st 2017)
Early bird fee	€ 730	(until February 2nd 2018)
Normal fee	€ 880	(until May 1st 2018)
Last minute + on-site fee	€ 1040	
Young Professional / Student fee **	€ 475	(until May 1st 2018)
Technical visit	€ 40	
Accompanying person fee	€ 50	
Congress Dinner for participants	€ 30	
Congress Dinner for accompanying persons	€ 80	
Refresher Course	–	no extra fee, registration obligatory

* Limited availability

** Applicants for this fee should be in the first decade of their career in Radiation Protection and preferably not be older than 35 years - limited availability

Registration Information

The Congress fee includes

- Participation in the whole scientific programme (including refresher courses, excluding a fee for technical visits)
- Access to the exhibition and sponsoring area
- Congress bag
- Admission to the reception on Monday
- Discount on the Congress Dinner on Thursday (regular fee € 80,-)
- Coffee and tea during the breaks

The accompanying person's fee includes

- Opening ceremony on Monday
- Welcome reception on Monday
- Coffee and tea during the breaks
- Closing ceremony on Friday

Young Professional / Student

Young Professionals and Students should be in their first decade as Radiation Protection professional and preferably not be older than 35 years. Applicants for the Young Professionals / Student fee should first send:

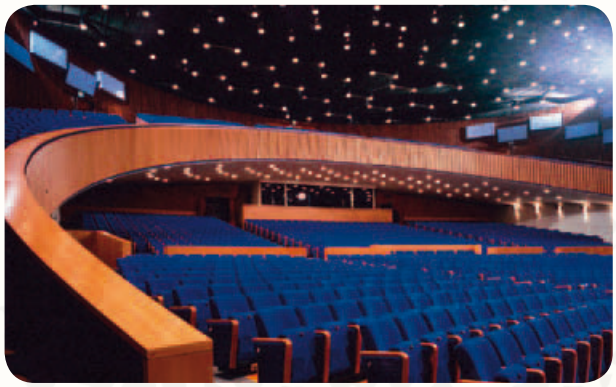
- Their date of birth
- The name of their institute or company

To info@irpa2018europe.com

Applicants will receive a unique registration code. Note that the organisation may require a proof of status before issuing this code.

CONGRESS VENUE: WORLD FORUM

The Congress will be held in the leading international convention centre the World Forum in The Hague. This convention centre is perfectly situated between the city centre and the beach. In 2014 it successfully hosted the Nuclear Security Summit (NSS), with the presence of many world leaders. Due to this summit, the World Forum has demonstrated that it is fully capable of hosting events on a high professional level. The venue provides a safe, secure and flexible environment.
www.worldforum.nl



ACCOMMODATION

Different accommodation options have been arranged by the organising committee, making sure all participants will have a hotel that suits their needs.

To make use of the different options, please use the corresponding booking links shown at our website (www.irpa2018europe.com/practical-information/hotels). Reservation for most hotels will be possible from June 2017 onwards.

HOW TO GET TO THE HAGUE

Located in the west of The Netherlands, The Hague is easily accessible by air, train or road. Rotterdam is less than 30 kilometres and Amsterdam approximately 60 kilometres from The Hague. Major European cities close to The Hague include Brussels, London and Paris, and there are trains to all major destinations.

Transport to The Hague

By air

The international airports of Amsterdam and Rotterdam-The Hague are just short distances away from The Hague.

Amsterdam Airport Schiphol can be reached by car in approximately 30 minutes and by public transport in about 45 minutes. A total of around 150 European airports and more than 100 intercontinental airports operate direct connections to Amsterdam, with more than 3,500 flights a week.

For business travellers visiting The Hague from abroad, flying to Rotterdam-The Hague Airport is another convenient option, with the airport located only around 20 minutes from the city by car and approximately 45 minutes by public transport. The fast check-in and check-out procedures enable travellers to save time. The airport operates scheduled services to and from a wide range of European destinations. For more information on the destinations that can be reached from Rotterdam-The Hague Airport, please visit www.rotterdamthehagueairport.nl/bestemmingen.

By train

The Hague has two international and well-equipped train stations. Trains from Hollands Spoor Station leave for Amsterdam, Rotterdam, Belgium and France. Trains for Utrecht and Germany leave from The Hague Central Station. Both train stations also operate a direct service to Amsterdam Airport Schiphol.

Getting around in The Hague

Walking

Getting about by foot is easy. The entire city, from the centre all the way to the beach at Scheveningen, can be traversed in under an hour. Over one third of the city is covered with greenery: forests and parks as well as some 70,000 roadside trees. It is a great setting for getting around by foot and grabbing some fresh air.

Public transport

The Hague boasts an excellent public transport system. Over 30 bus and tram lines will quickly and safely take you to your destinations in and around The Hague. There's also a night bus, so you can get home safely after a night out.
A public transport ticket for the city of The Hague is included in the registration fee.

Taxis

Special night rates do not apply in The Hague. It is often possible to hail a taxi in the street, but you can also find special taxi stands at the train stations and various points throughout the city. You can reliably order a taxi by telephone too.

HOW TO GET TO THE CONGRESS CENTER

By public transport

From The Hague Central Station you can reach the World Forum with:

» Tram 16 (get off at stop Statenplein, about 5-minute walk).

From The Hague Holland Spoor you can reach the World Forum with:

» Tram 1 (get off at stop World Forum, about 5-minute walk).
» Tram 16 (get off at stop Statenplein, about 5-minute walk).

Address location World Forum: Churchillplein 10, The Hague

SIGHTSEEING

Due to the many beautiful and cultural excursions possible in The Hague and its surroundings, the Congress organising committee has decided not to include a specific excursion programme. Instead of this, there will be a stand at the venue from the local convention bureau at which you can receive all information about The Hague and they will help you create your own excursion programme.

Het Binnenhof

Madurodam

Gemeentemuseum The Hague

Mauritshuis, interior

Mauritshuis

GENERAL INFORMATION

Congress Website
www.irpa2018europe.com

Congress Location
Churchillplein 10, The Hague, The Netherlands

For more information about the Congress, please contact:

Congress Secretariat
A Solution Events
Newtonlaan 51
3584 BP Utrecht, The Netherlands
T: +31 85 90 22 830
E: info@irpa2018europe.com

Register your interest
Complete the online form to be kept informed of all the latest news about the Congress if you are not ready to register yet.

We are grateful for the support of the UK Society for Radiological Protection (SRP) in establishing our scientific programme.

A Solution events

Dear Participant,

Welcome to the 5th European IRPA Congress in The Hague!

Please wear your badge at all times in the congress venue; attendees without a badge will be asked to leave the venue. Each day at the entrance and before some specific sessions your badge will be scanned by the organization for attendance registration.

Last week you received the login information for the congress app, please install the app and login if you have not already done this. The app shows the whole congress programme (you can create your own), information on the different presentations, the opportunity to connect with other attendees and the exhibitors and survey's on different aspects of the congress.

If you have registered for refresher courses, a technical visit, the congress reception and/or the congress dinner this is shown in your personal schedule in the app. If you have not registered for one of the options above and you would still like to attend, please ask the congress secretariat if it is possible to join. The scientific sessions and keynote presentations are open for everyone. You can add these sessions to your personal programme in the app.

The congress app will regularly ask you to complete a survey on specific parts of the programme. We appreciate it if you take the time for these survey's.

Please do not hesitate to ask the congress secretariat, at the registration desk, if you have any questions.

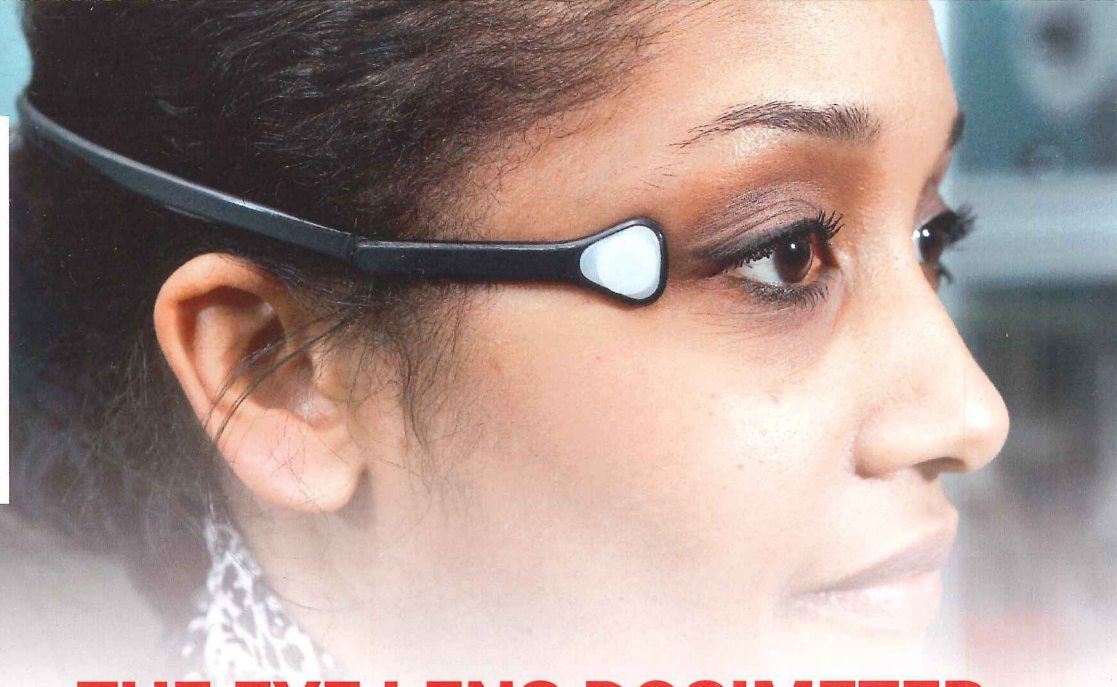
We hope you enjoy the congress!

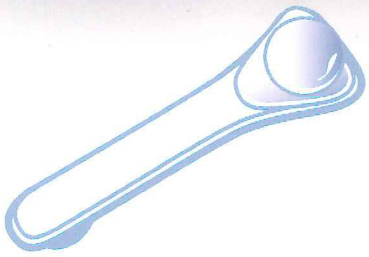
Kind regards,

IRPA 2018 Organization

5th European IRPA Congress 2018
Newtonlaan 51, 3584 BP Utrecht, The Netherlands
Telephone: +31 (0) 85 902 28 33
E-mail: info@irpa2018europe.com

IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE





THE EYE LENS DOSIMETER

DOSIRIS

DOSIRIS,
THE ESSENTIAL
SOLUTION TO
ESTIMATE THE DOSE
EQUIVALENT Hp(3)
IN YOUR SPECIAL
WORKING
CONDITIONS.

Some professional activities are identified **«at risk»** regarding the exposure of eye lens to ionising radiation. These specific situations require the implementation of **an appropriate radiation monitoring** because the indication provided by the chest dosimeter is not sufficient, and the wearing of a eye dosimeter is required.

DOSIRIS, the eye dosimeter developped by IRSN, is the solution to achieve this monitoring in the best conditions.

ERGONOMICS - TIPS FOR USING

- **DOSIRIS** can be worn **either left or right.** You place it on the side of the most exposed eye to radiations.
- The headband and its articulated arm allow to **ideally place DOSIRIS** to obtain **the best possible dosimetry** with **an unrivaled wearing comfort.**
- **The optimum position** is obtained when **the detection part** (white cap) **is placed as close to the eye corner,** against the temple and under the glasses, visors or protective mask.

Clear identification of the wearer with the label resistant to decontamination baths.

DOSIRIS is modular, the last axis is detachable for use without headband (inside masks for example).

THE BENEFITS OF DOSIRIS

- Lightweight, ergonomic ; adapted to all head morphologies.
- Adjustable in 3 axes, it can be ideally placed close to the eye and in contact with skin.
- It can be worn behind glasses or protective mask.
- Completly waterproof, it can be cold decontaminated.
- The identification of the wearer appears clearly on the label.

WORKPLACE STUDY

DOSIRIS

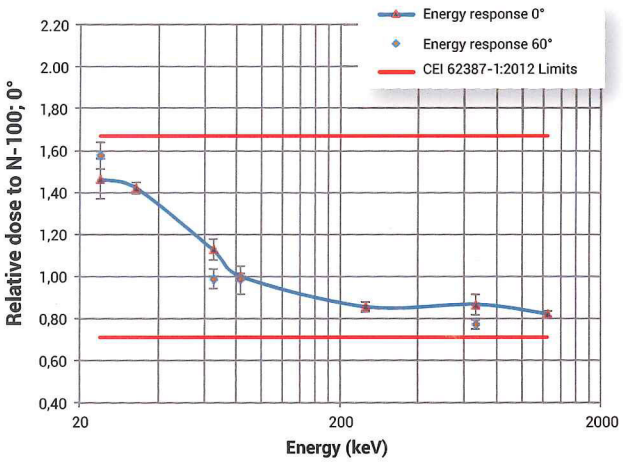
IS AVAILABLE FOR **WORKPLACE STUDY** OR FOR OCCUPATIONAL DOSIMETRY, **CONTACT US !**

PRINCIPLE OF DETECTION AND PERFORMANCE OF DOSIRIS

- DOSIRIS uses aThermo Luminescence Dosimeter (TLD).
- The detector is a TLD (7LiF : Mg,Ti) integrated in a 3 mm thick polypropylene cap.
- The system is calibrated to measure operational quantity for individual monitoring Hp(3).
- It complies with the requirements of IEC 62387-1: 2012 between 20 keV and 1.3 MeV.
- The identification of each detector is provided by **a circular bar code** that ensures traceability.

2-3 8

Hp(3) - Angular and energy response of DOSIRIS eye lens dosimeter.



Energy	Energy range (A)	Dose equivalent range
Photons (X and γ)	**De 20 keV à 1,3 MeV**	From 100 µSv to 50 Sv
Beta	**>700 keV**	Form 100 µSv to 50 Sv

(A) - **IMPORTANT:** These values are not operating limits, but satisfy the minimum and maximum energy available in the reference facilities which allowed to perform the tests.

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IRSN DOSIMETRY LABORATORY | 31, rue de l'écluse 78294 Croissy Sur Seine - FRANCE
dosimetre@irsn.fr | Tél. : +33 1 30 15 52 22 | Fax : +33 1 30 15 52 24 | dosimetre.irsn.fr

IRSN
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE

RadPro International GmbH

... Radiation Protection for the Radiation Professionals ...

TLD & OSL

We supply full spectrum of TLD and OSL systems, materials, dedicated equipment and software.

RadPro International GmbH

Schwanen 10
42929 Wermelskirchen
Germany
Phone: +49 2196 889803
E-mail: sales@radproint.de
Web: www.radpro-int.com

Food & Medical & Science

TLD Cube

Manual TLD Reader for all TL applications

MADE IN GERMANY

TLD Cube is a small, lightweight and portable TLD Reader with ceramic heater and optional nitrogen purging for all standard TLD shapes.
TLD Cube is available in two versions as TLD Cube 400 with heating capability up to 400°C and as TLD Cube 700 which provides heating capabilities up to 700°C.
The software TLStudio includes calibration and QA features, data storage and export options as xml file or Excel file to meet all typical requirements.

Lexsyg-smart and lexsyg-research

Automatic TL/OSL Readers for many TL and OSL applications

MADE IN GERMANY

Providing automatic evaluation of 40 or 80 samples in one load.
Heating temperature up to 500°C/710°C. Thermal and optical stimulation can be simultaneously operated. Up to 3 different stimulation lights in one system.

PSLfood

Manual PSL Reader for food testing and various OSL measurements

MADE IN GERMANY

PSLfood for fast is a newly developed PSL system for checking irradiated food according to EN 13751:2009 (Detection of irradiated food using photo stimulated luminescence). Compact design and new developed software combine easy operation and excellent performance.
The PSLfood drawer is designed for common petri dish with dimensions of 50mm in diameter & 20mm high.

myOSLchip

Manual stand-alone OSL Reader for OSL chip applications

MADE IN GERMANY

myOSLchip is the most compact and simple solution for single OSL chip applications. It reads and erases single capsulated OSL elements of about 1 cm² size with or without PC connection.

TL & OSL Material

TLD Materials (from RADCARD, former TLD-Poland)

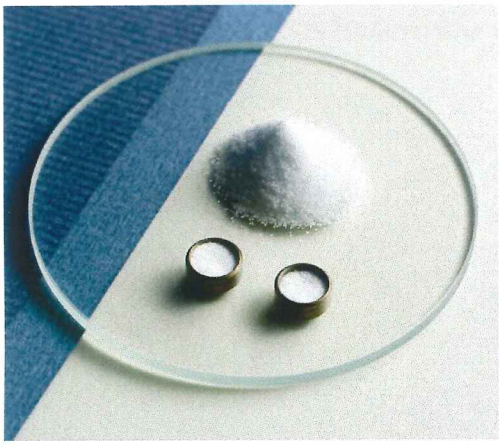
Probably the best TLD's in the world

Lithium fluoride thermoluminescent phosphor, in the form of powder, solid pellets and chips, is recognized universally as the "golden standard" for applications in radiation protection dosimetry, monitoring of environmental radiation and medical dosimetry.

MTS-N

MTS-N (LiF:Mg,Ti) has been produced since 1972 in the form of solid pellets, chips and powder, using unique method developed by Prof. Niewiadomski at the Institute of Nuclear Physics, Krakow, Poland.

- Fully exchangeable with with LiF:Mg,Ti phosphors, chips and pellets produced by other companies,
- Used world-wide in radiation protection, environmental monitoring and clinical dosimetry.



MCP-N

MCP-N type ultra-sensitive thermoluminscent LiF doped with magnesium, copper and phosphorus (LiF:Mg,Cu,P), available as solid detectors or in the form of powder.

- 30 times more sensitivity to gamma ray doses than MTS-N
- Unmatched for environmental monitoring and personal dosimetry.

TLD-Powders

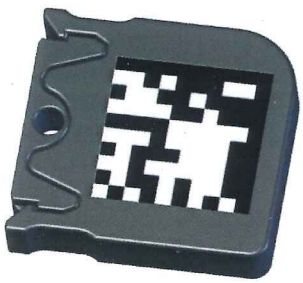
TLD Powders for dosimetry in medical physics:

- Beam dosimetry
- TLD Quality Assurance for postal reference dosimetry
- Typical grain size 80 – 200 µm (customer specified)

MCP-Ns

MCP-Ns (LiF:Mg,Cu,P) thin active-layer ultra-sensitive TLD designed to measure Hp(0.07) in external fields of weekly penetrating radiation. Each pellets consists of a thin radiation-sensitive part, of 8.5 mg*cm² effective thickness, bonded to a thick, mechanically stable, non-luminescent LiF matrix.

- Flat energy response after X-ray and ß-ray doses
- High sensitivity-reliable measurements of Hp(0.07) in the µGy range



OSL Materials

BeO detectors and myOSLchip dosimeters

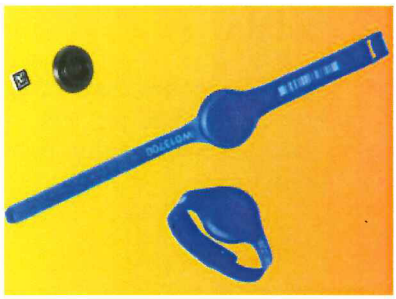
BeO detectors

- lose chips of 4.7 mm x 4.7 mm x 0.5 mm
- sensitivity optimized and sorted

myOSLchip dosimeters

- removable BeO detectors covered in a plastics housing
- 2D code label (rear side) and readable number (front side)
- Size: 10 mm x 9.5 mm x 2 mm

TL Dosimeters



TLD finger ring dosimeter

for all applications in extremity dosimetry

- Type G: photon radiation
- Type BG: beta and photon radiation

Eye lens TLD dosimeter

the best solution for monitoring of $H_P(3)$ doses.

- Interventional radiology
- Nuclear medicine
- Medical diagnostics
- Nuclear Industry

H*(10) - Environmental dosimeters

Gamma-Sphere & DORIS for environmental dosimetry

Gamma-Sphere for use with two loose TLD chips or discs.
Doris can either be equipped with aluminum TLD cards or RADOS TLD cards.

Albedo Neutron Dosimeter Cases

Dosemeter cases for individual monitoring of personal exposure to thermal neutron radiation

The boron plastic Albedo covers are available to accommodate the TLD cards of different TLD card manufacturers.

TL Dosimeters & Accessories

TLD Aluminium Cards

Multi-element aluminum dosimetric cards

Our aluminum dosimetric cards, with one to four TL pellets or chips, sealed in fluoro-polymer (e.g. PTFE), can be evaluated in all compatible hot-gas readers.

Genesis Card-Holder

Card holder for aluminum dosimetric cards

The Genesis allows for reporting of deep, lens of eye and shallow doses, and has a thin Mylar window for detection and measurement of low energy beta radiation.

Vacuum Tweezers

With tube and handpiece

Vacuum tweezers for proper handling of lose TLD elements and elements used in dosimeters like EYE-D and finger ring.
Silent operation and convenient positioned power switch on top of the pump.

IR-200

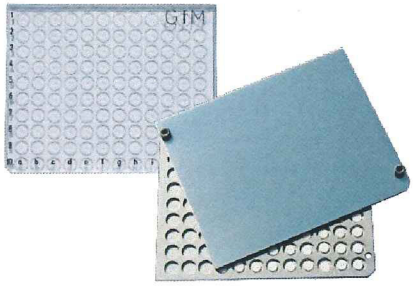
Table Top irradiator

MADE IN GERMANY

The TLD/OSL Irradiator IR-200 is a multi-purpose irradiation system. The compact and versatile device requires only little space on the table. It is used for calibration purposes of TLD/OSL elements or cards and QA of the TLD/OSL system.

Carrier discs for different TLD elements like rods, chips and discs, BeO elements, as well for aluminum TLD cards and TLD Slides type "Rados". The irradiation value is defined by the number of carrier disc revolutions.

The IR-200 contains a 90Sr/90Y radiation source with an activity of 33 MBq.



Annealing tray and storage dish

Both with cover

Annealing tray and storage fit together for easy and fast transfer of detectors between dish and tray.
Annealing tray fits in TLD Heat.

TL & OSL Accessories

MADE IN GERMANY

TLD Heat

TLD annealing oven for thermoluminescent dosimeters

The TLD annealing oven TLD Heat with air circulation has specially been developed for thermo-luminescent dosimetry.
It has a PC interface and Win software for easy and flexible programming and saving of any required heating profile for preheat and anneal of TLD material to a maximum temperature of 400°C.

MADE IN GERMANY

LED Light Eraser

Eraser for BeO

With tray for 24 myOSLchip dosimeters or BeO detectors

RSD ART Phantom

THE ALDERSON RADIATION THERAPY PHANTOM (ART)

The Worldwide Standard for Quality Assurance for Radiation Therapy

RadPro International GmbH

...Radiation Protection for the Radiation Professionals...

Email: sales@radproint.de
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