

奧地利健康暨食品安全署

輻射防護業務介紹

一、前言

奧地利健康暨食品安全署(Österreichische Agentur für Gesundheit und Ernährungssicherheit, AGES)成立於 2002 年，營運經費主要來自「聯邦勞動、社會事務、衛生和消費者保護部(Bundesministerium für Arbeit, Soziales, Gesundheit und Konsumentenschutz, BMASGK)」以及「聯邦永續發展和觀光部(Bundesministerium für Nachhaltigkeit und Tourismus, BMNT)」。

該署任務是支援聯邦部會，在醫藥及醫療設備、公眾健康、食品安全、動物衛生、糧食安全、輻射防護等方面之業務，員工有約 1500 人。AGES 與我國關係密切，我國食藥署及疾病管制局皆與 AGES 簽訂合作備忘錄，針對食品安全、醫藥品安全、傳染病等方面交換資訊及派員訪問。今(107)年 6 月 12 日陳秘書彥甫、張秘書瀚昌、何秘書怡潔赴 AGES 輻射防護處於維也納之辦公室，拜會處長 Dr. Christian Katzlberger 與「輻射防護和放射化學組」組長 Dr. Claudia Landstetter，並參觀 AGES 實驗室，期望拓展我方與奧地利在輻射防護領域之技術交流。

二、AGES 輻射防護處組織編制與設備

AGES 輻射防護處設有三個組，共有約 40 人，辦公室分設於奧地利境內各處，「輻射防護和放射化學組」位於維也納，其下另有兩間放射實驗室位於格拉茲及因斯布魯克；「輻射防護和技術品質保證組」位於維也納；「氬氣與放射生態組」位於林茲。AGES 實驗室配

置有各式輻射偵測儀器，總計有 24 台加馬能譜分析儀、5 台阿伐能譜分析儀、5 台液態閃爍計數器、1 台感應耦合電漿質譜儀(Inductively coupled plasma-mass spectrometry, ICP-MS)，以及數台手持式劑量計、汙染偵檢器等。

三、AGES 輻射防護業務

(一) 環境輻射監測

AGES 於奧地利境內空氣與水之環境偵測取樣站位置分佈如圖 1 所示，有懸浮微粒取樣器、懸浮微粒高量取樣器、碘取樣器、沉降取樣器、地表水取樣站，此外，AGES 也會定期採取蔬菜、草、土壤、肥料、牛奶...等項目進行分析。檢測樣品內之放射性含量，如 Cs-134, Cs-137, I-131, Sr-90, Rn-222, H-3, Ra-226, Ra-228, Po-210, Pb-210, Sr-90, Plutonium-, Americium-, Uranium-, Curium- Isotopes 等，並將量測結果提供給聯邦管制機關 BMASGK 與 BMNT。每兩年 BMASGK 則會出版一份綜合分析報告，公佈奧地利境內放射性活度和輻射偵測結果與趨勢變化。

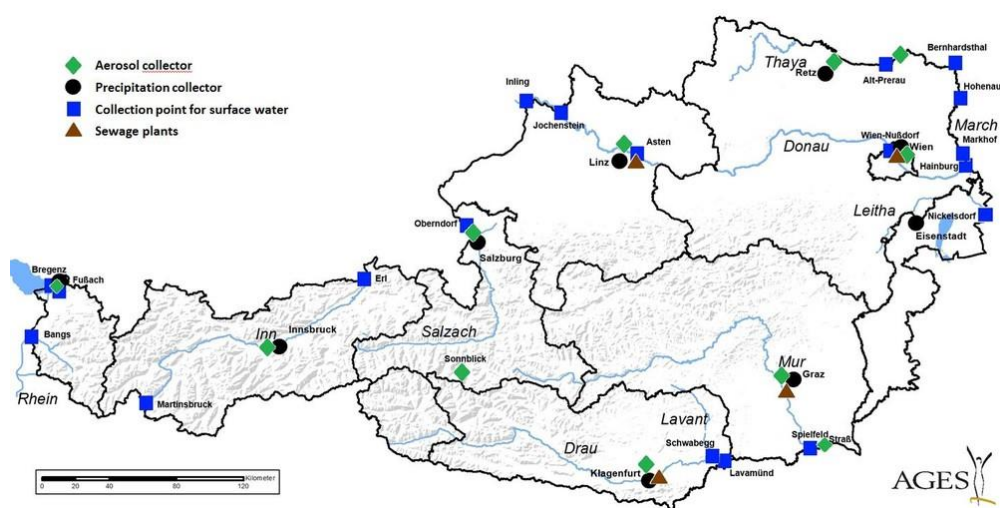


圖 1、奧地利環境取樣站分佈圖

(資料來源：[AGES 網站](#))

(二) 食品輻射檢測

陳秘書說明我方近年針對日本食品進口抽樣輻射檢測數量很多，輻射檢測程序是依據「食品中放射性核種之檢驗方法」檢驗食品中碘-131、銫-134 及銫-137 放射性比活度，K 處長回應表示 AGES 是依據 ASTM D 7784 “Standard Practice for the Rapid Assessment of Gamma-ray Emitting Radionuclides in Environmental Media by Gamma Spectrometry” 製訂加馬能譜分析檢測作業程序，有關我方使用高純銻加馬偵檢器(HPGe)進行檢測的需求量很大，於現場參訪時渠特別向我方介紹 AGES 建置之資料庫系統，該系統可管制檢測作業流程並與加馬能譜分析軟體 GENIE 2000 連結整合，樣品登錄於資料庫時同時輸入待測物幾何形狀，相關參數將會自動提供 GENIE 2000 設定檢測分析所需資料，最後 GENIE 2000 的檢測報告會自動回傳至資料庫系統。此外，AGES 還有一台捷克 NUVIA 公司所製造之 HPGe 自動換樣品機台(如圖 2)，單一批次可量測 60 個樣品。以上所述自動化軟體與設備，對檢測作業效率提昇有很大幫助，K 處長建議我方可參考導入。



圖 2、HPGe 自動換樣品機台

(資料來源：[NUVIA 網站](#))

(三) 輻射緊急事故應變檢測

若奧地利發生輻射緊急事故，AGES 是專責輻射檢測實驗室，各邦政府將會採取樣品送至 AGES，由 AGES 檢測分析樣品之放射性物質含量，彙整檢測結果提供給聯邦管制機關 BMNT 進行研判。K 處長表示透過自動化檢測作業程序，AGES 於緊急應變演練時每天可以加馬能譜分析檢測 140 組擦拭樣品，此外，針對緊急事故應變也發展出一系列快速檢測作業程序，以 ICP-MS 或是阿伐能譜分析儀檢測食物樣品內之超鈾元素，以及使用移動式液態閃爍偵檢器量測總貝他與總阿伐強度，並於緊急應變演習時實際測試檢測作業程序。由於奧地利境內並無核能電廠，K 處長表示輻射緊急事故演練是假想境外核電廠發生事故，外釋物質則選擇對人員劑量貢獻佔比較高之放射性元素 Curium。

AGES 除了參與緊急事故演習外，平時亦負責整備作業，並參與國際原子能總署(IAEA)、經濟合作暨發展組織核能署(OECD/NEA)、歐盟執委會之緊急應變工作小組，及與 IAEA 合作協助其他國家建置緊急應變能力。

K 處長另表示奧地利有一套輻射早期預警系統，由 BMNT 負責營運，已建置超過 30 年，是歐洲最早建立的自動輻射監測系統。奧地利境內約有 300 個量測點，位於 AGES 維也納辦公室戶外之加馬射線輻射偵檢器如圖 3 所示，這些輻射偵檢器每 10 分鐘會自動傳回數據，其中有 111 個量測站的數據會顯示於 BNMT 網站。除了監測環境的加馬射線輻射強度外，奧地利還有 10 組空氣監測器可自動與連續量測空氣中懸浮微粒的阿伐、貝他、加馬射線強度，所有量測數據均會同步傳送至聯邦輻射緊急應變中心進行監控。



圖 3、輻射早期預警系統之輻射偵檢器(位於 AGES 維也納辦公室)

(四) 輻射防護技術服務

AGES 也對外提供輻射防護安全評估技術服務，協助核設施如研究用核子反應器、放射性廢棄物處理設施等，設計放射性物質外釋監測計畫，評估公眾與環境因核設施和活動釋放之放射核種所接受到之劑量，以及設施除役、環境復原、放射性廢棄物管理與處置等之安全評估。K 處長另說明奧地利境內有歷史廠址(Legacy sites)，如生產鐳的工廠、鐳實驗室、鐳銷售站、鈾工業等，其廠區內某些區域的放射性強度偏高，AGES 也協助管制機關調查、監管與環境復原。

2013 年歐盟修訂游離輻射曝露防護之基本安全標準 (Basic Safety Standards for Protection Against the Dangers Arising from Exposure to Ionising Radiation - Directive 2013/59/EURATOM)，增列對天然放射性物質(Naturally Occurring Radioactive Materials, NORM)相關管制要求，AGES 則協助支援奧地利管制機關評估 NORM 相關產業及建議管制作法，針對工作人員於製造過程會接近天然放射性物質之產業，如煉油業、稀土產業、玻璃製造業等，AGES 也提供技術諮詢，協助業界評估工作人員劑量和天然放射性物質殘留量等。

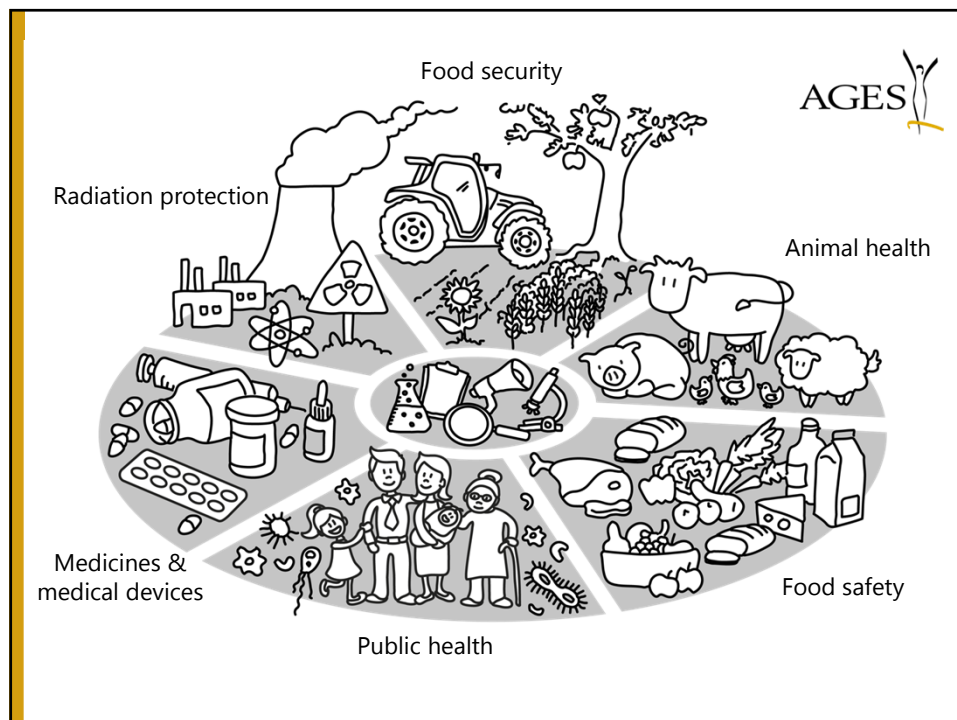
四、結語：

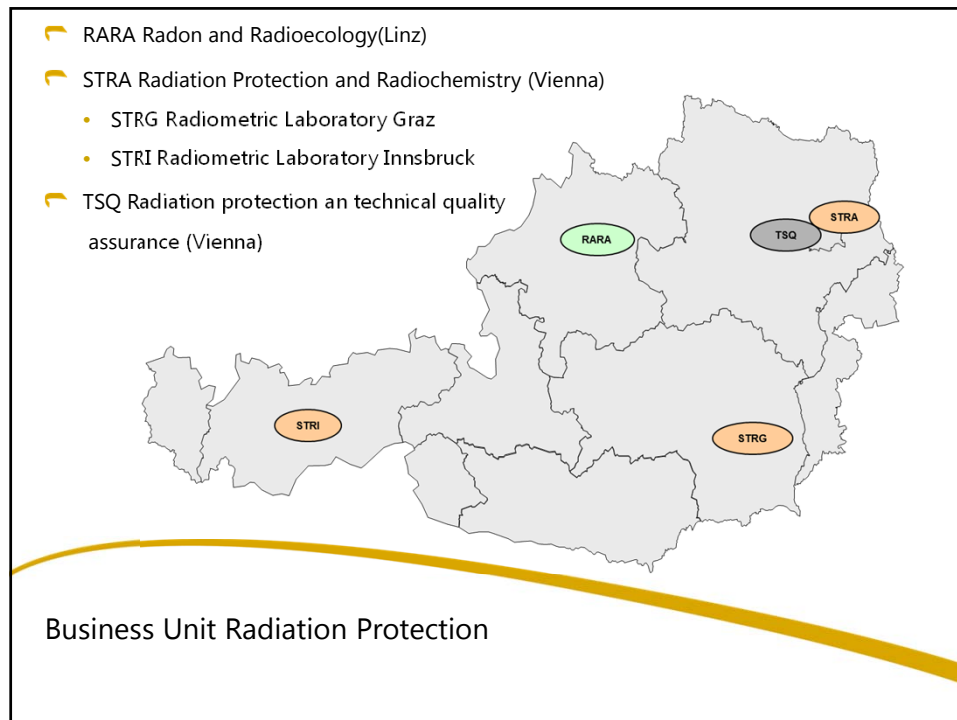
AGES 輻射防護業務有環境輻射監測、食品輻射檢測、輻射緊急事故應變檢測，並對外提供輻射防護安全評估技術服務。為提升輻射檢測作業效率，AGES 已投注很多資源與心力建置自動化輻射檢測程序，並協助國際性組織推廣緊急事故應變檢測技術，此外，對近年國際間關注 NORM 應用對公眾造成之潛在輻射曝露問題，AGES 也協助相關單位進行評估並建議適當的管制作法，相關技術與經驗均值得參考，建議我方未來可與 AGES 就輻射防護領域進行技術交流。

Division for Radiation Protection

Dr. Christian Katzlberger

Division for Radiation Protection





Services –Technical Radiation Protection



General

- Development and management of safety assessments and safety cases for decommissioning, remediation, radioactive waste management and disposal of nuclear facilities
- Assessment of doses to the public and environment from radionuclide releases from nuclear facilities and activities
- Design of monitoring programs for emissions and immissions
- Accompanying consultation for NORM industry

Services –Technical Radiation Protection



Selection of services

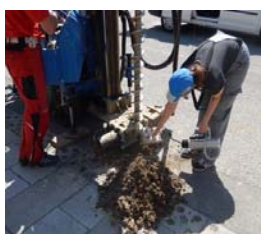
- ☞ Establishing safety analysis reports
- ☞ Project management
- ☞ Supervision of radiological legacy site remediation
- ☞ Dose assessment for occupational workers in the NORM industry
- ☞ Assessment of residues occurring in NORM industries
- ☞ Support in license procedures regarding installation, amendments and operation of nuclear facilities

References – NORM industry



Handling of Natural occurring radioactive materials

- ☞ Consulting of the Oil and Gas industry
- ☞ Consulting of the Rare earth industry
- ☞ Consulting of the glass manufactures
- ☞ Consulting of small scale NORM enterprises (eg. Stone works)



References - legacy sites



Legacy sites

- ☞ Historical research and research of suspected areas 2007 – present
- ☞ Survey, supervision of remediation of legacy sites of the radium industry
 - Radium production in lower Austria 2007-2010
 - Radium laboratory in urban areas 2010
 - Radium point of sale in urban areas 2011
- ☞ Survey of legacy sites of the thorium industry
- ☞ Production of Thorium consumer goods 2012 – present
- ☞ Survey and supervision of the remediation after an accidental release (Am-241) 2013-2015

References as Technical Support Org.



Research reactors and radioactive waste processing facilities

- ☞ Design of monitoring programs for emissions and immissions (Austrian Institute of Technology, IAEA facilities).
- ☞ Accompanying consultation of Austrian government by authorization, amendments and decommissioning proceedings (Nuclear engineering Seibersdorf, IAEA facilities).
- ☞ Assessment and classification of contaminated sites.
- ☞ Assessment and consulting on planned, existing and emergency exposure situations.
- ☞ Assessment and consulting the competent authority in release of material and clearance of sites.

Governmental support (as TSO)



Emergency preparedness

- ☞ Responsible laboratory in case of emergencies
- ☞ Capability buildup for other countries
(in cooperation with IAEA)
- ☞ Emergency exercise (e.g. INEX 5, Convex-3 and National Exercises)
 - Preparation
 - Performance
 - Evaluation
- ☞ Participation in working groups
(e.g. OECD-NEA, IAEA, EC, SKKM – national working groups)
- ☞ Support of competent authorities in emergency cases

Governmental support (as TSO), cont.



Support of competent authorities

- ☞ Implementation of the EU-BSS directive regarding NORM
 - Identification of relevant industrial practices
 - Elaboration of an appropriate regulatory control („graded approach“)
 - Support in stakeholder involvement, alignment of exemption and clearance values, regulation of consumer products, etc.
- ☞ Result: proposals for law and ordinance with respect to NORM
- ☞ Elaboration of type approvals for devices with ionizing radiation

Laboratory

Sampling equipment - environment monitoring



Aerosol Sampler
88 Nm³/h
Glass microfiber filter
GF/A



High Volume
Aerosol Sampler
780 – 1000 Nm³/h
Polypropylen G-3



Iodine Sampler
4.5 Nm³/h
Carbon Cartridge,
Glass fiber filter



Deposition Sampler

Laboratory

Measurement equipment



24 Gammaspectrometers

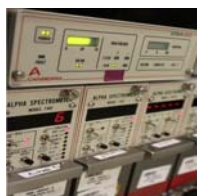


5 Liquid Szintillation Counter

1 ICP-MS

Handheld measurement
devices:

- dose rate meter
- Contamination Monitors
- Alphaguards (radon)



5 Alpha Spektrometers

Laboratory

Specials



- Accredited as an Examination Centre by Akkreditierung Austria with the PSID number 378 in accordance with ISO / IEC 17025

The accredited test scope is published under

www.bmwfw.gv.at/TechnikUndVermessung/Akkreditierung

- Sample and data management - high Sample throughput
Automatization (eg. Gammasspectrometry for emergency planning (140 pd), wipe test)
- Radio-chemical methods in radiation protection including process development for/with consumers

Analytics

Selected products



- Radiometric analysis in:
 - Food (e.g. Cs-134, Cs-137, I-131, Sr-90)
 - Drinking water (e.g. Rn-222, H-3, Ra-226, Ra-228, Po-210, Pb-210, Sr-90, Plutonium-, Americium-, Uranium- Isotopes)
 - building materials, NORM materials
 - consumer goods
 - fertilizers
 - technical samples
- Export certifications
- In-situ measurement
- Analytical Training
- Sealed radioactive sources – Leakage test





Capabilities Radiation Protection AGES

Dr. Claudia Landstetter
Division Radiation Protection
Department Radiation Protection and Radiochemistry

www.ages.at

Österreichische Agentur für Gesundheit und Ernährungssicherheit GmbH

Laboratory-based monitoring network



- Sampling stations
- Laboratory equipment
- Analysis
- Rapid methods

www.ages.at

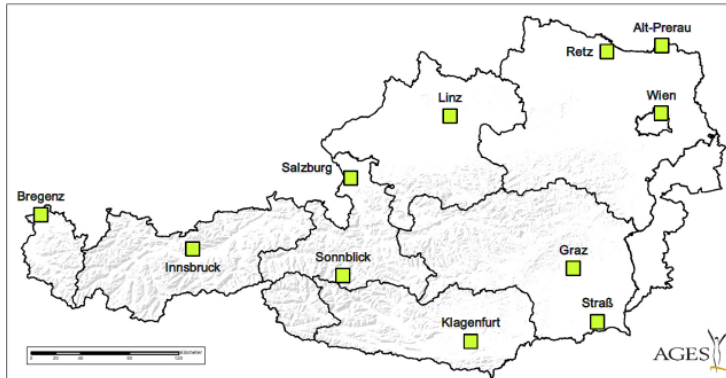
Claudia Landstetter, 12.06.2018

2

Aerosol Samplers



- 11 sampling stations
- Measured weekly (Sonnblick daily)
- 880 samples per year

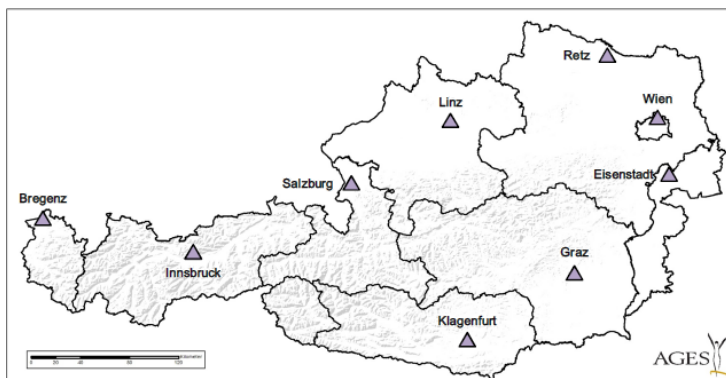


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Deposition Samplers



- 9 sampling stations
- Measured monthly
- 108 samples per year

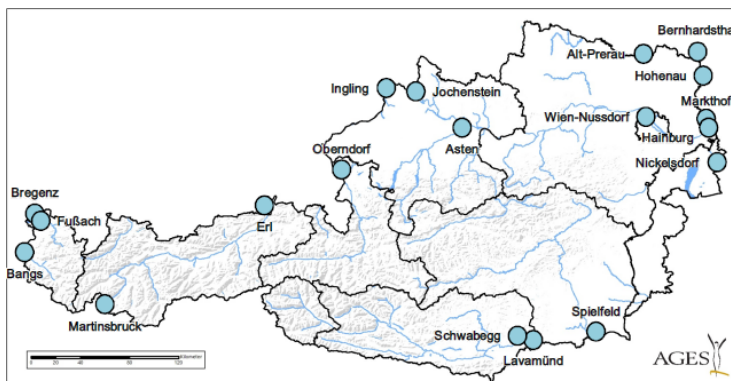


www.ages.at

Surface Water Sampling



- 19 sampling stations
- Measured monthly
- 228 samples per year



www.ages.at



Aerosol Sampler
88 Nm³/h
Glass microfiber filter
GF/A



High Volume
Aerosol Sampler
780 – 1000 Nm³/h
Polypropylen G-3



Iodine Sampler
4.5 Nm³/h
Carbon Cartridge,
Glass fiber filter



Deposition Sampler

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6

Surface Water



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7



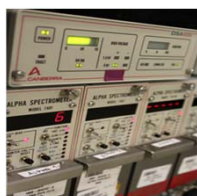
24 High Resolution Gamma Spectrometry
In-situ Gamma Spectrometry



5 Low Level Liquid Scintillation Counting



1 ICP-MS



13 Alpha Spectrometry

Portable Measuring Instruments
Alphaguards
Contamination Monitor
Dose Rate Meter
Triathler (Portable Liquid Scintillation Counter)

Laboratory Equipment

www.ages.at

Gamma Spectrometry



- Aerosol filters
- Carbon cartridges
- Deposition samples
- Food samples
- Fertilisers
- Feeding stuff
- Surface water and water samples

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Alpha Spectrometry



- Plutonium in water, food samples, soil, vegetation
- Americium in soil, vegetation, water
- Uranium in water, food samples
- ^{210}Po in water, food samples
- Curium emergency exercises

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LSC



- ^3H in water samples
- Gross $\alpha + \beta$ in water
- ^{226}Ra , ^{228}Ra , ^{210}Pb , ^{210}Po in drinking water
- ^{90}Sr in milk, mixed diet, drinking water, foodstuff
- ^{90}Sr in soil, cereals, grass
- ^{210}Pb in food samples

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ICP-MS



- ^{238}U in water and digested samples
- ^{239}Pu in food samples
- Determination of the chemical recovery ^{137}Ba , ^{138}Ba , ^{86}Sr , ^{88}Sr , ^{208}Pb
- Heavy metals

www.ages.at

Rapid Methods



- Plutonium in foodstuff with ion-exchange and ICP-MS (^{239}Pu) or alpha spectrometry
- Portable Liquid Scintillation Counter for gross alpha and gross beta measurements
- Used in emergency exercises for plutonium isotopes, strontium, americium and curium

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Rapid Methods

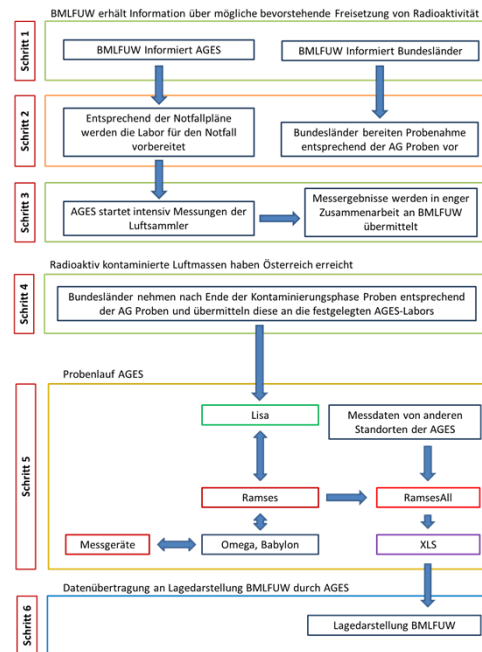


Pu and Transuranium Elements

- Simplified procedures for a known nuclide or nuclide vector (local or regional accident with a known source)
- Gamma spectrometry for ^{241}Am (if present), determination of nuclide vector, then only Gamma Spectrometry for dose estimation (evtly. total alpha)
- Ion-chromatography with ICP-MS (not for infant food) or alpha spectrometry +

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Emergency



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Projects

- Fertilizers (natural radionuclides by γ)
- Consumer products (natural radionuclides by γ)
- Caves for touristic use (radon)
- Monitoring program NPP
- Rapid methods (Transuranium, Strontium, portable LSC)
- Groundwater (natural radionuclides by LSC)
- Building Materials,...

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Results



Database transferred to the BMLFUW and BMG via Excel and e-mail.

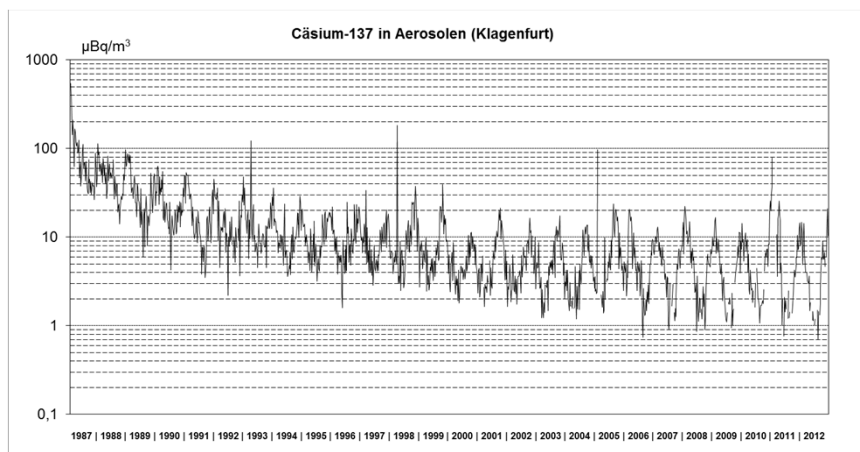
Published every second year

http://www.bmg.gv.at/cms/home/attachments/0/5/4/CH1238/CMS1253800995913/radioaktivitaetsbericht_11_12_zusammengefuehrt.pdf

Emergency: transferred to the Situation Reporting System via Excel

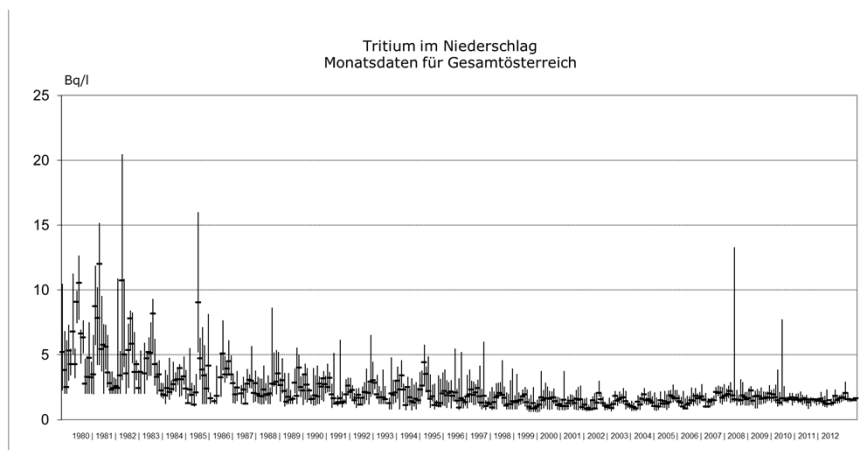
www.ages.at

Results



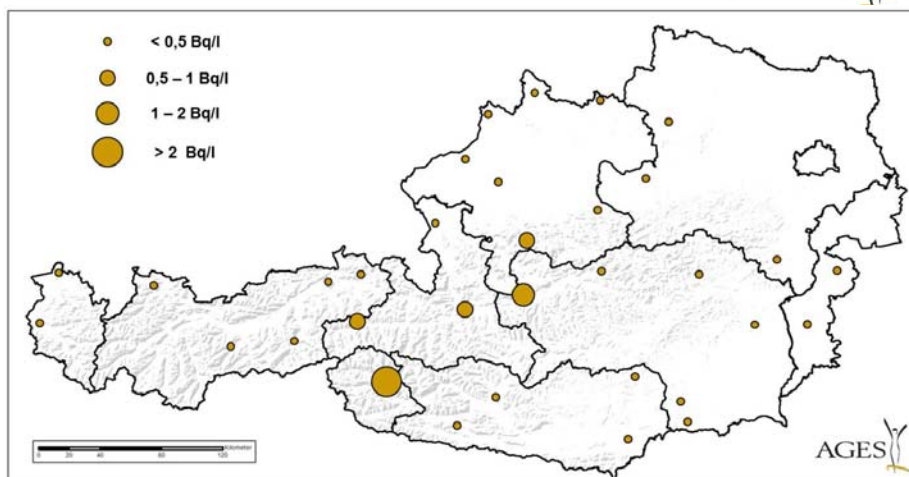
www.ages.at

Results



www.ages.at

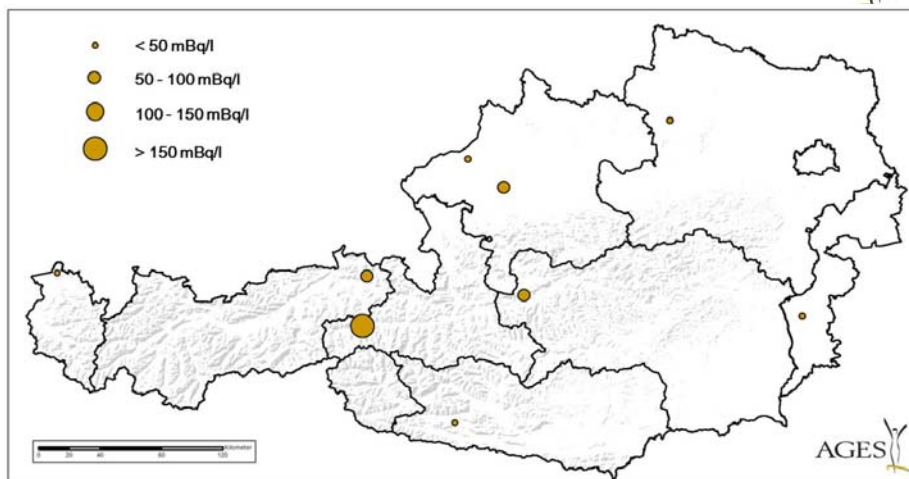
Cs-137 in Milk 2013/14



www.ages.at

Sr-90 in Milk 2013/14

AGES



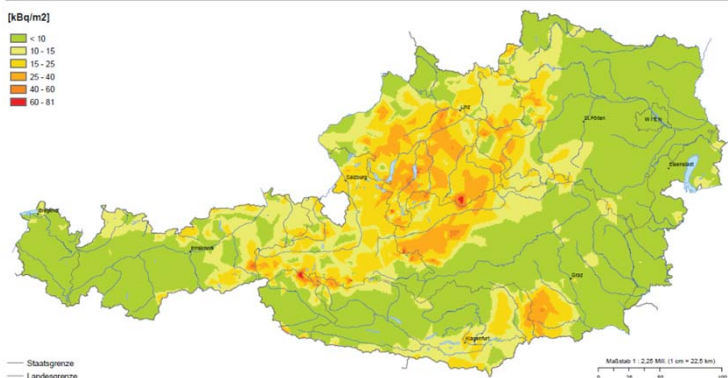
www.ages.at

Cs-137 AUT 2016

AGES

Bodenbelastung durch Cäsium-137 bezogen auf 1. Mai 2016

[kBq/m²]



Quelle: BORG Datenbank
Bearbeitung: Umweltbundesamt, März 2016

umweltbundesamt



Thank you

www.ages.at