



Federal Office for
Radiation Protection

Concerning explosives and radioactive materials stashes

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Introduction

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Introduction

- 2021 was a rather quiet year as far as incidents with radioactive materials was concerned – until October...
- Police report about a member of the armed forces having been arrested and the flat he lived in was searched
- Violation of the German War Weapons Control Act
- State colleagues were tasked with identifying substances that were marked radioactive
- Only two weeks later police called our offices and requested some back office help on a case developing in Braunschweig
- 2TBq(!) of Ni-63
- Possible involvement of TATP



Aldenhoven

- On the 14th of October a police report arrived at BMUV
- Police had raided a flat in Aldenhoven
- Member of the armed forces had sent pieces of a WWII machine gun through the Frankfurt airport to a foreign contact, violation of the German War Weapons Control Act
- Suspect was a member of the EOD unit of the army
- Search of the premises yielded several IEDs and illegal weapons as well as substances marked radioactive
- State experts were called in after the IEDs were destroyed to investigate the found substances

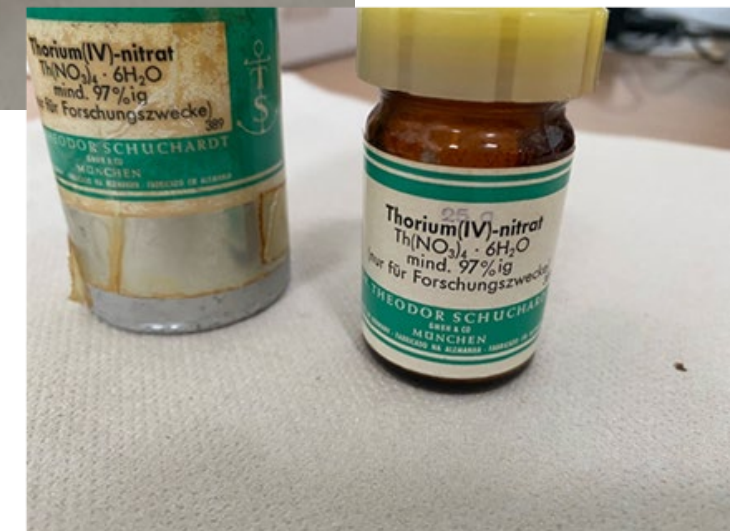
Aldenhoven

- State experts from NRW LIA (Landesinstitut für Arbeitsgestaltung) made sure the crime scene investigation was safe and took four substances into their facility to analyse the contents
- No Contamination was found at the crime scene
- Other chemicals were found that were not radioactive



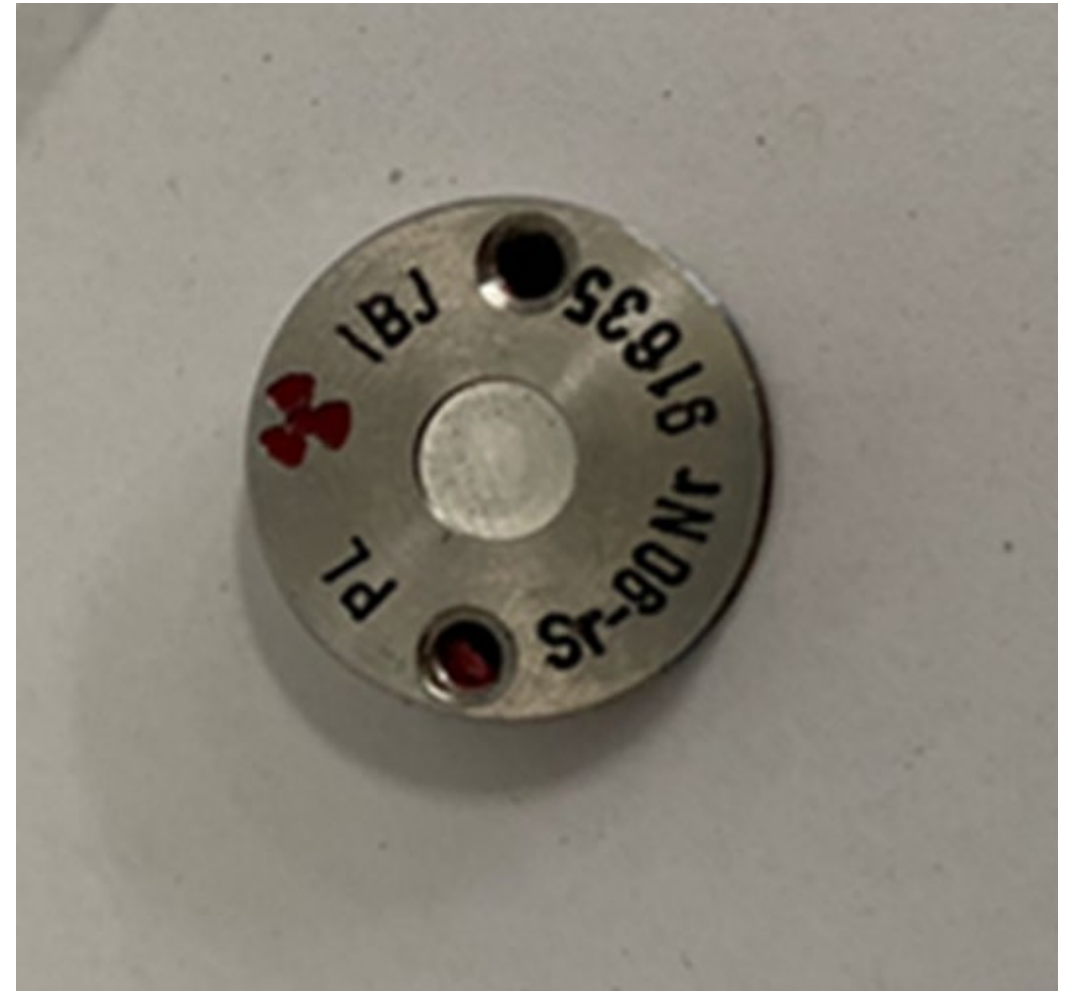
Aldenhoven

- The police raid was all over the news in Germany
- Just weeks before this raid, a right wing sympathizer had been arrested in France close to the German border who had built IEDs and was suspected to turn them into dirty bombs
- Because of the public attention, BMUV prepared an internal information file for the press officers, detailing the known facts and what to reply in case of reporters contacting the authorities



Aldenhoven

- 1st piece of evidence is a Sr-90 calibration source with an open window, marked „PL IBJ Sr-90 Nr 91635“
- Markings lead to a Polish supplier of sources, Instytut Badan Jadrowych
- IBJ was a predecessor of Polatom, which still produces calibration sources to this day
- Activity was determined to be 3.9 kBq (exemption limit 10 kBq in Germany)



Aldenhoven

- 2nd piece of evidence is an unmarked piece of metal in a plastic pouch
- Identified as containing Sr-90
- Unable to determine the origin of this particular source
- Activity was determined to be 9.7 kBq of Sr-90



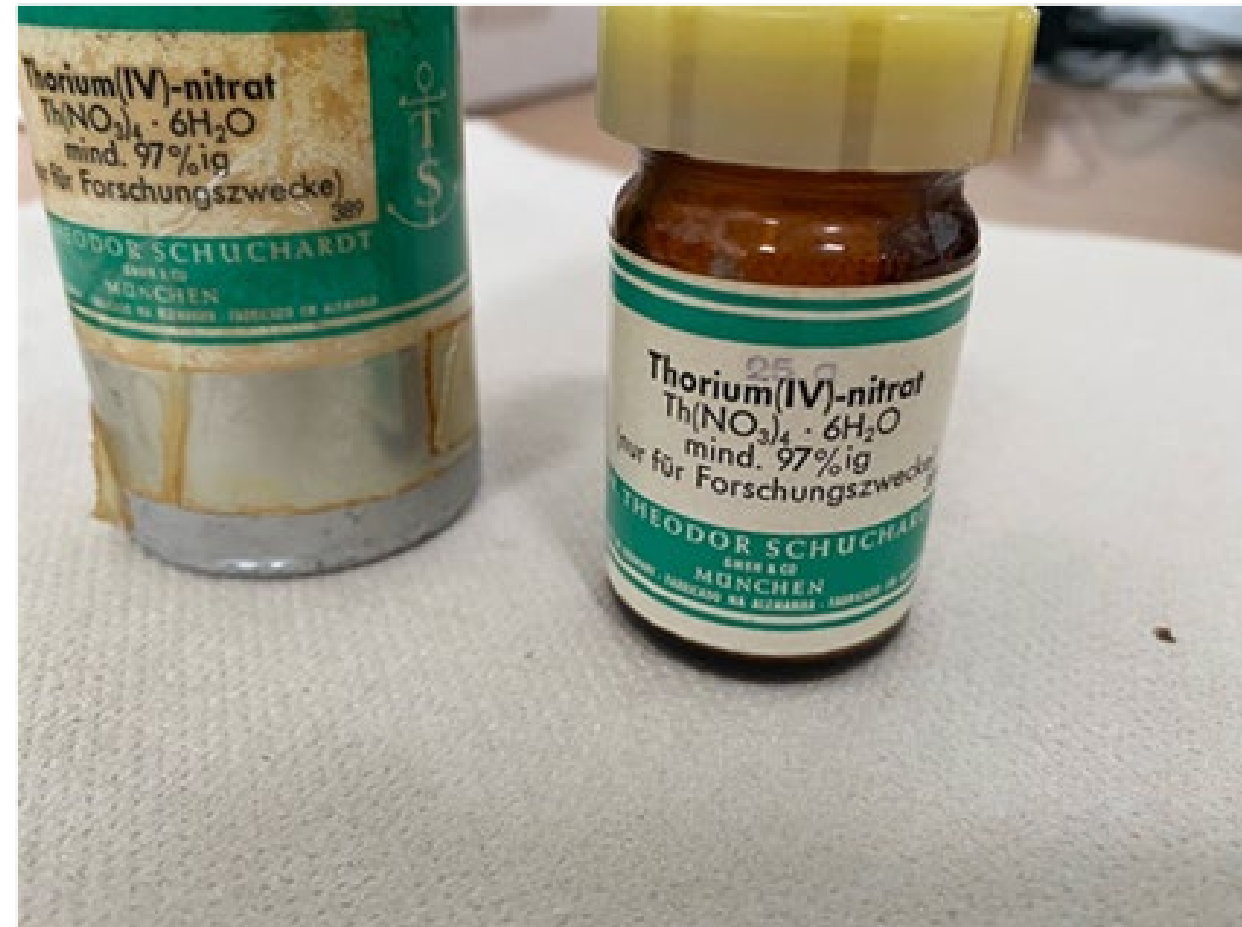
Aldenhoven

- 3rd piece of evidence was a source of unknown origin
- Found in a metal shielding container marked as radioactive
- High-purity germanium detector used to make the identification: Am-241
- Dose rate at a distance of 10 cm from the source was 3 $\mu\text{Sv/h}$
- Activity was determined to be 270 kBq (exemption level in Germany is 10 kBq)



Aldenhoven

- 4th piece of evidence was kept in its original packaging by Merck-Schuchardt
- Used to be a common over the counter chemical purchasable without license
- Approximately 15 g Thorium-IV-nitrate *6 H₂O, therefore about 6 g Thorium
- 6 g Thorium means ~ 24.3 kBq Th-232+ (exemption limit in Germany is 1 kBq)





Aldenhoven

- 2 out of the 4 sources were over the exemption limit
- None of the sources were a risk to the health of the investigators
- Could have been potentially used in a „dirty bomb“ given the background of the suspect
- Suspect proved cooperative in the investigation and was released from prison in March 2022
- Authorities determined him to be an excessive collector of militaria and dangerous substances
- Suspect did not plan any acts of violence

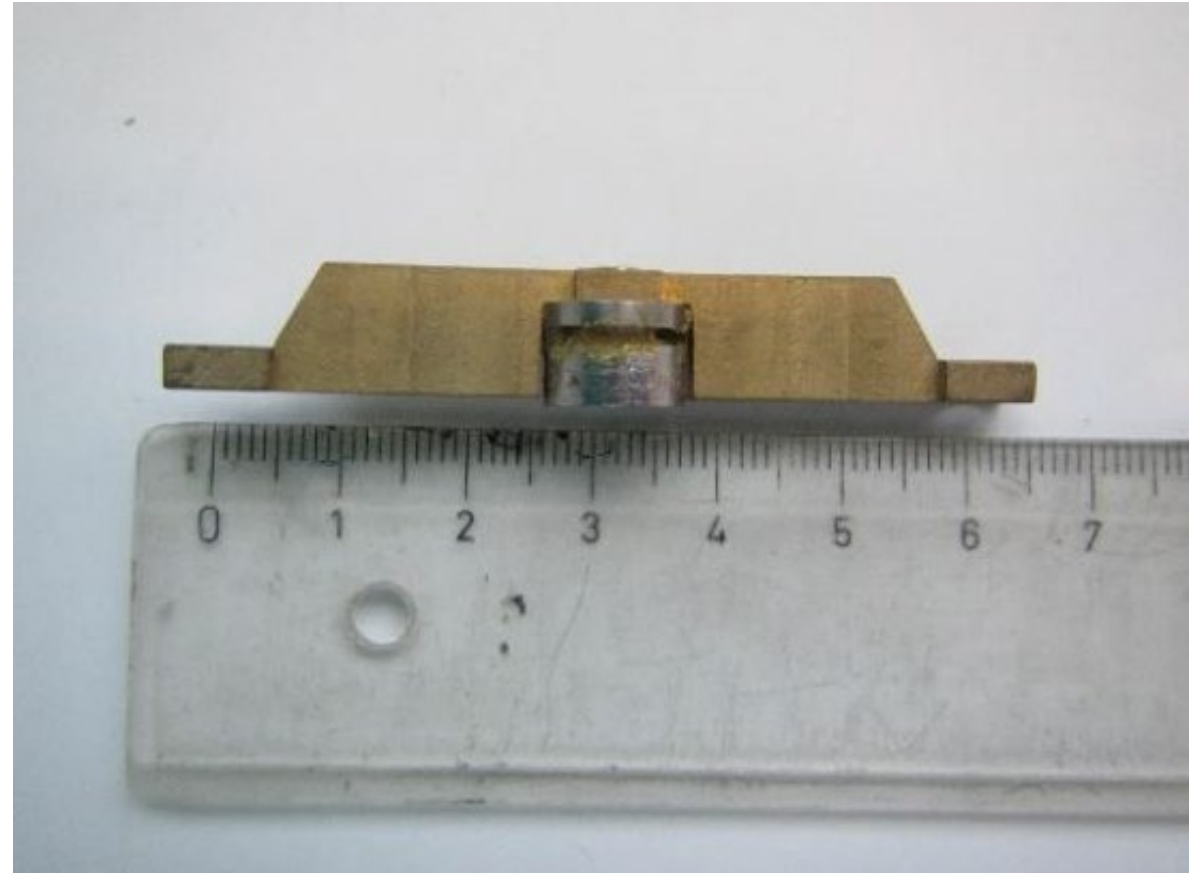


Braunschweig

- On the 24th of October, a member of the police in Lower Saxony called BfS to ask questions related to a missing source
- 2 TBq (!) of Ni-63 was mentioned in the call
- The case developed over several days.
- An employee of a local source manufacturer
- He had made threats against the life of his former superior at the source manufacturer who was about to terminate his employment
- As a known gun owner the police investigated the threat and searched his house
- During the interrogation the suspect admitted to having radioactive material in his possession
- Experts from the State environmental protection agency were tasked with finding and securing the material

Braunschweig

- The case got more complicated over the course of the next several days
- In the house of the suspect the experts found contaminated work materials, chemicals and weapons
- It became clear, that the case was linked to the disappearance of over 2 TBq Ni-63 solution from the source manufacturer in 2006
- House of a relative was also searched, Pu-238 sealed source was found



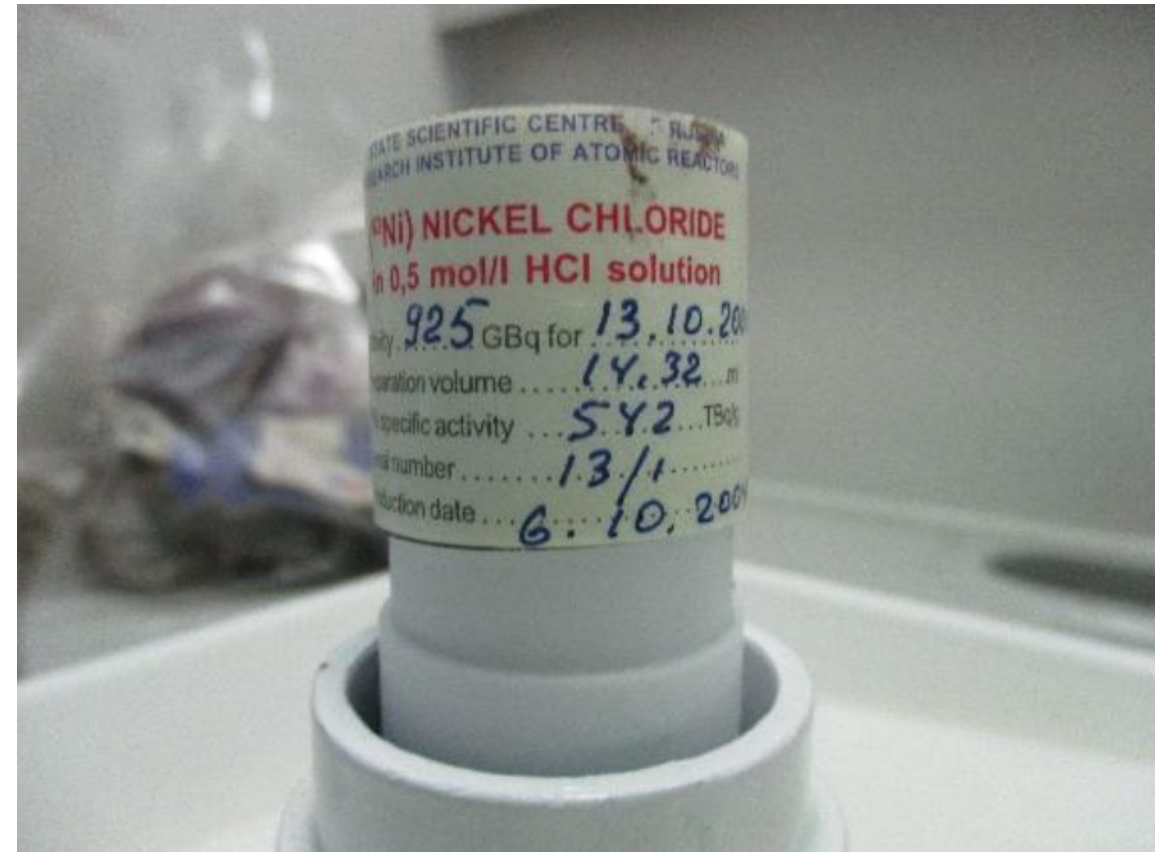
Braunschweig

- Ni-63 is a technical radionuclide that is mainly used as a source in gas chromatographs
- Low energy beta emitter (<70 keV)
- Not much shielding needed
- Material was produced in Russia
- Stolen from the source manufacturer in 2006 – reason unknown
- Activity at the time of theft was $\sim 2 \cdot 10^{12}$ Bq, half-life of 100.6 years
- Exemption limit: $1 \cdot 10^8$ Bq



Braunschweig

- Suspect claimed to have buried the Ni-63 source in a meadow close to the estate of the relative
- Suspect also claimed to have produced 500 g of TATP, which he also buried in the meadow
- A careful search took two days to produce the missing Ni-63 in a lead shielding container
- One of the two vials in the container had a broken lid, leading to 10 kg of contaminated earth to be disposed of



Braunschweig

- Activity in the contaminated earth was ~100 MBq
- The activity was completely recovered





Braunschweig

- Risk assessment, 5 scenarios:
 1. Dose following ingestion of the whole source
 2. Dose following ingestion of the whole source depending on the time it remains in the body
 3. Dose after inhalation of the whole source
 4. Dose after release through the waste water path according to QSA global
 5. Dose after inhalation following release
- Results:
 1. Lethal dose (between 300 and 3200 Sv depending on age)
 2. Between 60 and 242 Sv depending on the assumed time
 3. 2200 to 4600 Sv depending on age
 4. 119 to 283 μ Sv due to thinning with water
 5. Between 0.1 and 2.4 mSv depending on scenario and timeframe

Braunschweig

- Pu-238 found was labeled as 30mCi, equivalent to $1.11 \cdot 10^9$ Bq
- Unknown date of determination
- Halflife of 87.74 years, exemption limit $1 \cdot 10^4$ Bq
- Measured dose rate 51 μ Sv/h in contact
- Stolen from the same source manufacturer



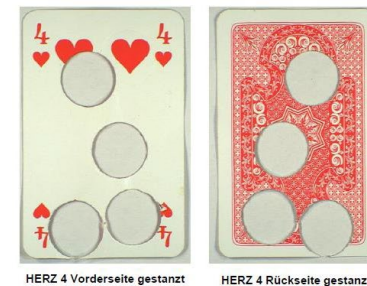


Insider Threat – what do we learn from these incidents?

- Material that has gone missing is still out there – you cannot assume to never come across it again!
- What is the value of trustworthiness checks?
- How well do you know the people who work for you?
- What could prevent the theft of radioactive materials?

What are common radionuclides that are difficult to keep track of?

- „White van“ with a density/moisture gauge
- In general any source that is meant to be „mobile“ (industrial sources)
- Pharmaceutical radionuclides (only short term problem though!)
- NORM (ore samples etc.)
- Old check sources (former business premises)
- Uranium chemicals at e.g. university labs



HERZ 4 Vordersseite gestanzt

HERZ 4 Rückseite gestanzt



Originalkartenspiel (nachträglich beschafft)





Ad-hoc WG on Alternative Technologies

- Ad-hoc group was founded in 2015 by the U.S. and France
- Germany joined as co-chair in 2018
- Aim is to provide an open forum for States to share information, ideas, views, and experiences on the use of alternatives to technologies that use highly radioactive sources
- Annual meetings on the sideline of IAEA conferences
- Steady growth of the interest group
- Broad array of subjects
 - Blood irradiation
 - Research irradiation
 - Radiotherapy
 - Industrial sterilization
 - Food safety
 - Radiography
 - Well logging



Ad-hoc WG on Alternative Technologies

- Since outbreak of the Corona pandemic, meetings are conducted virtually
- Massive increase in registered participants:
 - ~ 60 participants for in-person events
 - ~ 300 participants this week
- Two days each with a three-hour video-conference
- Presentations and posters sessions
- First time: participation of industry (in poster sessions)
- Topics last year:
 - Alternatives to mobile sources (e.g. well logging industry)
 - Environmental applications of accelerator technology
 - WINS video tour: Electron beam processing – a Mexican experience
 - Success stories about operating x-ray blood irradiators
 - Use of medical linear accelerators – innovation and change

Visit our website at <https://alttechwg.org/>

Summary

- Two cases within two weeks in October last year involving weapons, explosives and radioactive materials
- Both suspects created explosives themselves
- One of them threatened the life of a co-worker
- Intention of the original theft in Braunschweig is still unclear
- Difficult investigations involving experts from the police and radiation safety authorities
- Classical „secret stash in the woods“ scenario





Summary

- Missing material can show up again in unexpected circumstances!
- How well do you know the people who work for you?
- How well do trustworthiness checks work?
- Alternative Technologies can be used to reduce the risk of malicious use of radioactive materials



Federal Office for
Radiation Protection

Thank you for your attention!

Legal Notice

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