

From Potential Hazard to Alpha Therapeutic

Dr. Michael Haschke
DMT (TÜV NORD Group)

Hazardous Source



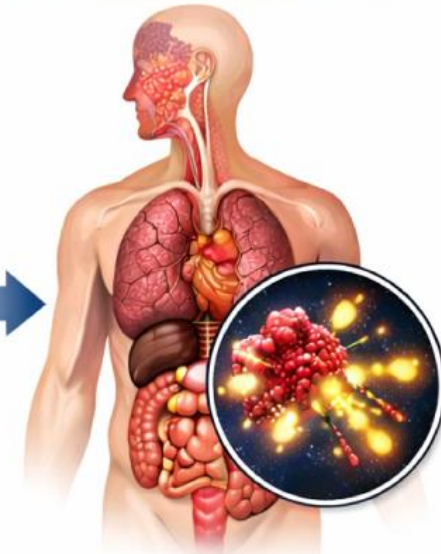
Phosphogypsum
Leaching Radium-226

High-Purity Ac-225 Production



Proprietary Accelerator-Based Method
Ra-226 → High-Purity Ac-225

Cancer Therapy



Targeting & Destroying
Cancer Cells

SpectronRx + DMT

Member of TÜV NORD GROUP

TÜV NORD GROUP

Headquarter in Hannover, Germany

Industrial Service,
Mobility, Training

TÜVNORDGROUP

Energy & Resources

DMT

Michael Haschke
Innovation & EU Relations

Aerospace

ALTER

IT

TÜVIT

Focus Markets



Innovation Performance

Inventor

Patented Ra-Recovery

from PG for Radiopharmaceutical Industry as source material for oncological cancer (alpha) therapy

EU Key Innovator

>60 Innovation Projects

Corporate Sustainability

EcoVadis Platinum 2024-2025

EcoVadis Gold 2020-2023

Top 1% of 150,000 companies in 180 countries

INSEAD Executive Edu

Business Sustainability
Strategic R&D Management

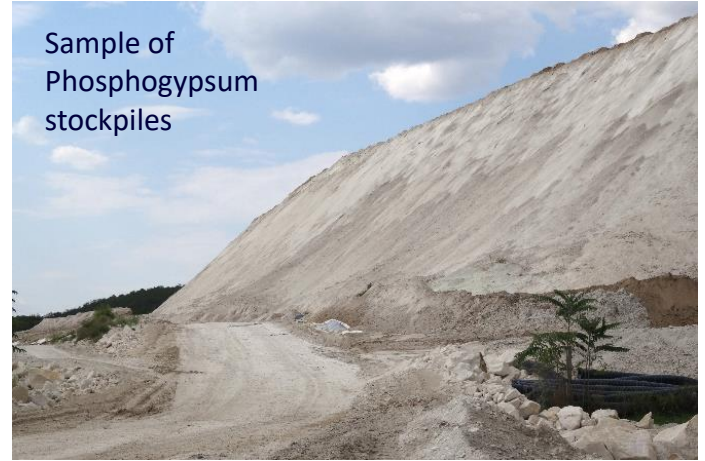


Bewertung der TÜV NORD GROUP bei EcoVadis

Specific Project Idea

- **Develop a licenced pilot plant** for Radium extraction (as Ra-226) from phosphogypsum (PG) at ~60 t/day.
- **Waste product** in the phosphate fertilizer industry (e.g. 15,000 t/day OCP).
- Mildly radioactive (Ra-226): **800-1,200 Bq/kg** derived from NORM in sed. phosphate.
- **USPTO/PCT patent** (TRL 3-4) for **Ra-226 extraction** from PG with efficiency 73% → **Licencing Available**
- Ra-extraction enables
 - 1) **Ra-226 raw material** for production of radiopharmaceuticals (Ac-225) for alpha therapy
 - 2) **PG recycling** (cement, gypsum, REE 1-2%)
 - 3) **PG stockpile recycling** (e.g. Huelva, FL, Moroc)
- **Regulatory support** from IAEA, UNECE, USA, EU, India, China, Brazil ...

Sample of Phosphogypsum stockpiles



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 January 2026 (02.01.2026)



(10) International Publication Number
WO 2026/005812 A1
US 2026/0002236 A1

(51) International Patent Classification:

C01F 11/46 (2006.01) *C22B 60/02* (2006.01)
C05B 11/02 (2006.01) *C22B 7/00* (2006.01)
C22B 1/00 (2006.01) *G21F 9/30* (2006.01)

DMT GMBH & CO KG [DE/DE]; Am Tuv 1, 45307 Essen (DE).

(72) Inventors; and

(71) Applicants: **HASCHKE, Michael** [DE/DE]; c/o DMT GmbH & Co KG, Am TUV 1, 45307 Essen (DE). **BORNHOFT, Marie Charlotte** [DE/DE]; c/o DMT GmbH & Co KG, Am TUV 1, 45307 Essen (DE).

(21) International Application Number:

PCT/US2024/055997

(22) International Filing Date:

14 November 2024 (14.11.2024)

(72) Inventors: **ZEHNER, John A.**; 8262 Bowline Ct., Indianapolis, IN 46268 (US). **WEBNER, Peter**; 14943 Mancroft Dr., Fishers, IN 46037 (US). **TRUMP, David**; 12281 Pennyroyal Ln., Granger, IN 46530 (US).

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

63/664,532 26 June 2024 (26.06.2024) US

(74) Agent: **MAYBERRY, Michele L.**; New River Valley IP Law, PC, PO. Box 10944, Blacksburg, VA 24062 (US).

(71) Applicants: **VILLAGE ENTERPRISES, INC.** [US/US]; 9801 Fall Creek Road, #135 Indianapolis, IN 46256 (US).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,

(54) Title: SYSTEMS AND PROCESSES FOR THE RECOVERY OF 226RA FROM PHOSPHOGYPSUM

PG as Strategic Inventory

Robust business models for PG recycling:

- **PG gypsum recycling** to compensate for lack of FGD gypsum from phase-out of coal energy production by 2038 (6 million t/yr Germany).
- Extraction of **1-2% magnet-relevant REE** for CRM supply
- **Ra-226 is purified & irradiated for production of Actinium (Ac-225) as active ingredient in radiopharmaceuticals** for targeted alpha (cancer) therapy (alternative to chemotherapy)
- **Ra-226 is sought-after high-value raw material:** 1 gr Ra-226 costs US\$ 3.7-6 million (source: U.S. Dept. of Energy).

Targeted Alpha Therapy

- Alpha-emitter (Ac-225) linked to a **carrier targeting molecule** (peptide, antibody) **to target tumor cells.**
- Ac-225 injected into patients' bloodstream.
- Transports alpha-emitters to cancerous cells by **recognizing antigens on the surface of tumor cells** (even if spread throughout the body).
- **Targeting molecules** selectively bind to tumor cells, unlock/enter cancerous cells, deliver a predefined dose of radiation (5-9 MeV) to break cancerous DNA (α -radiation range <0.1 mm/ <10 cell diameters) to prevent growth of cancerous tissue, with min. damage to healthy cells.

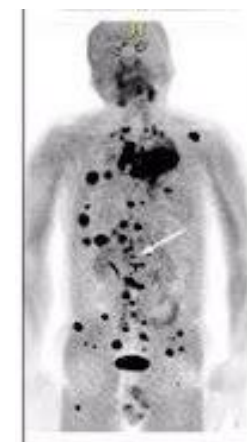
Type and Role of Partners

- **Partners sought:**
 - **Patent-licenced engineering partners** for design, construction, implementation of pilot plant/demonstrator (e.g. phosphate operators, Uni's with engineering Depts)
- Ra-226 extraction from PG moves **fertilizer industry to forefront of medical oncology.**
- **Robust business models for PG recycling**, now refined by **adding Ra-226** as raw material for production of radiopharmaceuticals (Ac-225).
- Growing international demand (e.g. USA, UK, China (HongKong), India)



“Alpha Therapy
Nuclear Waste gives precious lifetime to cancer patients”

The Great Reversal – From Potential Hazard to Alpha Therapeutic



Participant #27