FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

Business Plan

Business Administration - WS 2016/2017

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Business Plan of the

Radioactive Protection Engineering GmbH

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I. Background

At December 2013 the Council of the European Union enacted the COUNCIL DIRECTIVE 2013/59/EURATOM, laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation, and repealing inter alia the 96/29/EURATOM council directive.

The new directive replaces the previous council directive from 1996 for the protection against ionizing radiation and has to be implemented in nation law by 2018 at latest.

Therefore the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (German: Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit – BMUB) is drafting a new legislation at the moment, by which the German radiation protection law should be modernized and drafted as implementation-friendly as possible.

The result is the new Federal Law on Actions on the Protection of Life or Health of Humans including their progeny against Damages arising from exposure to Ionizing Radiation (German: Bundesgesetz über Maßnahmen zum Schutz des Lebens oder der Gesundheit von Menschen einschließlich ihrer Nachkommenschaft vor Schäden durch ionisierende Strahlen, kurz: Strahlenschutzgesetz – StrlSchG)

Among the essential innovations are:

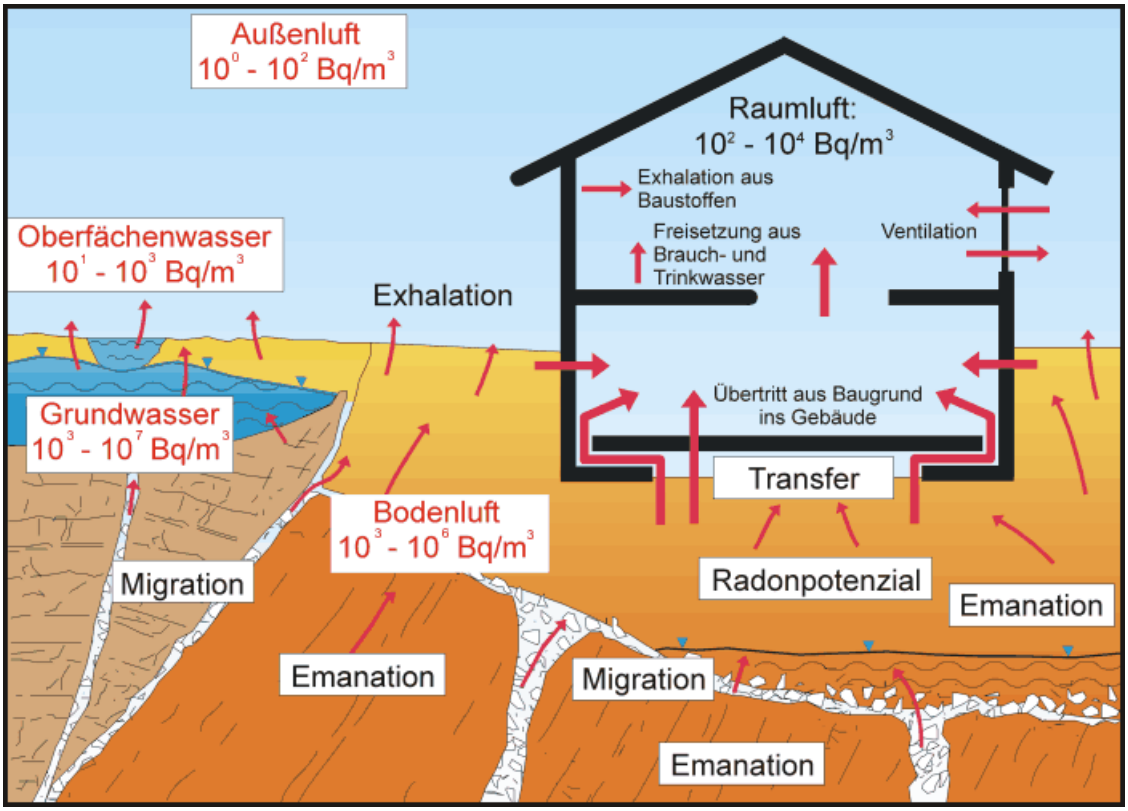
- **Actions for the protection against the naturally occurring radioactive noble gas Radon, which can occur at working places and residential buildings and that can cause lung cancer.**

- **Regulations for the mastery of radiological legacies (→ decision measurements for clearance of radioactive waste and release from supervision)**

i. Background: Radon and its Hazards

In the meanwhile there are new scientific research results on the relationship between Radon in interiors and lung cancer. It is assumed that in Germany approximately 1,900 of the 40,000 annual new diagnosed lung cancer cases can be classified as being caused by the inhalation of indoor radon. Recent epidemiological findings from residential studies demonstrate a statistically significant increase of lung cancer risk from prolonged exposure to indoor radon at levels of the order of 100 Bq/m^3.

Radon occurs naturally in the environment as a result of decay of radioactive elements in the soil and it can accumulate in houses built on areas where such decay occurs.



The new Council Directive 2013/59/Euratom laying down basic standards for protection against the dangers arising from the exposure of the radioactive gas Radon.

In particular chapter III “System of Radiation Protection”, article 5, sentences 3 about “general principles of radiation protection” defines:

For existing exposure situations involving exposure to radon, the reference levels shall be set in terms of radon activity concentration in air as specified in **Article 74** for members of the public and **Article 54** for workers.

Article 74

Indoor exposure to radon

Member States shall establish national reference levels for indoor radon concentrations. The reference levels for the annual average activity concentration in air shall not be higher than 300 Bq/m^3.

Article 54

Radon in workplaces

Member States shall establish national reference levels for indoor radon concentrations in workplaces. The reference level for the annual average activity concentration in air shall not be higher than 300 Bq /m^3, unless it is warranted by national prevailing circumstances.

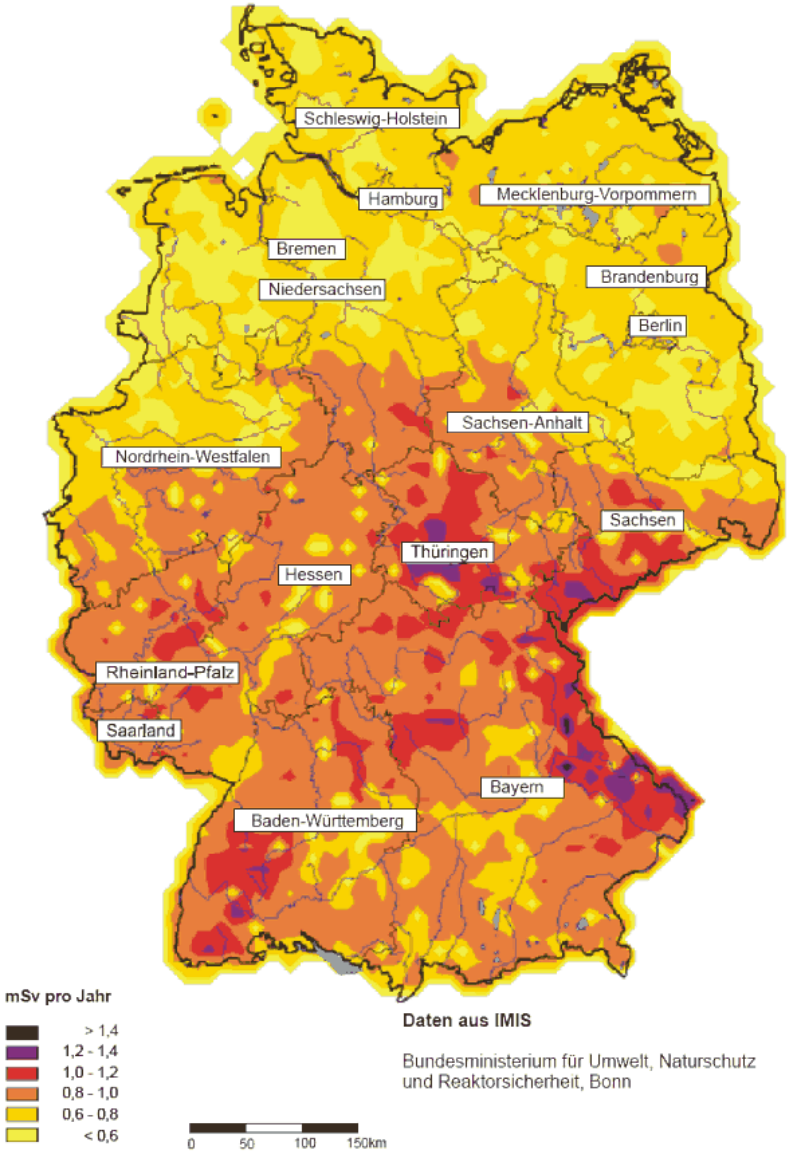
Furthermore, article 103 defines a so-called “Radon action plan” as follows:

1. In application of Article 100 (1), Member States shall establish a national action plan addressing long-term risks from radon exposures in dwellings, buildings with public access and workplaces for any source of radon ingress, whether from soil, building materials or water. The action plan shall take into account the issues set out in Annex XVIII and be updated on a regular basis.

2. Member States shall ensure that appropriate measures are in place to prevent radon ingress into new buildings. These measures may include specific requirements in national building codes.

3. Member States shall identify areas where the radon concentration (as an annual average) in a significant number of buildings is expected to exceed the relevant national reference level.

For this purpose co-called “Radon precautionary areas” are defined, based on the radioactivity concentration in the soil air whose regional concentration can be depicted in a soil air map as follows:



The following classes can be defined:

Radon precautionary areas type I: radon concentration of 20 bis 40 kBq/m^3
Radon precautionary areas type II: radon concentration of > 40 up to 100 kBq/m^3
Radon precautionary areas type III: radon concentration of > 100 kBq/m^3

In practice, this means that in future:

- **Radiological characterization of new building areas before expulsion.**
- **Measurements of the radon concentration in existing buildings and, if necessary, construction measures for decreasing of the Radon concentration.**

In summary, it can be said that for the future the importance of Radon concentration measurements will increase tremendously in significance and competent service providers, like the *Radioactive Protection Engineering GmbH*, specialized in this field become obligatory.

ii. Background: Clearance of radioactive substances

Nuclear waste is not only produced during the operation of a nuclear power plant, but also during the decommissioning of the nuclear power plant after its shut down. Overall, 300,000 up to 500,000 tons of material (concrete, metal, plastic, electronic waste, glass, tools, etc.) are produced after the complete decommissioning of one nuclear power plant.

At the present time only three of the 36 commercial nuclear power reactors are fully decommissioned, 16 are under decommissioning, and 9 nuclear power plants are shut down (decommissioning in planning) respectively 8 nuclear power plants are still in operation. Not mentioned are the so-called research reactors.

In the year 2001 the Ordinance on the Protection against Damage and Injuries Caused by Ionizing Radiation, in short: Radiation Protection Ordinance (in German: Verordnung über den Schutz vor Schäden durch ionisierende Strahlen , kurz: Strahlenschutzverordnung - StrlSchV) was amended.

Since then, the competent authority at the destination is allowed to release nuclear material, produced during the decommissioning work, under the prerequisite that for private individuals the effective dose in the range of 10 micro Sievert per calendar year cannot be exceeded (§29, StrlSchV). As a result the radioactive material is no longer under supervision of the responsible authorities and can be treated as normal waste.

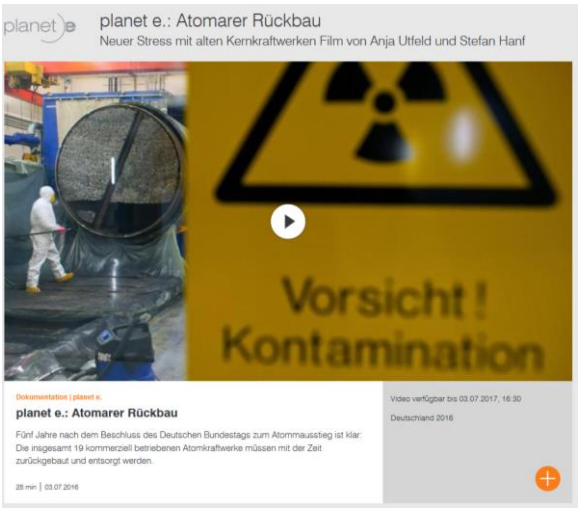
All activities on-site, especially the so-called “clearance-measurement” of radioactive waste (this means the determination of the activity of the radioactive waste), are supervised by an independent inspection organization such as TÜV in charge of the licensing authority. The clearance measurements are of essential importance because their quality makes sure that the amount of waste is reasonable and the sites and materials released meet the requirements for a safe clearance.

Unfortunately, as a result of the financial dependence of the (independent) inspection organization on the operator of the nuclear power plant, there can be an influence on the quality of the work of the inspection organization, especially in the field of clearance measurement.

Competent authorities are increasingly interested in instructing in German so-called “atomkritische Sachverständige” for supervising of decommissioning work and especially clearance measurement of radioactive waste.

In summary, it can be said that with the decision of the Federal Government in 2011 to shut down the remaining nuclear power stations by 2022 at the latest, the market for decommissioning of nuclear facilities and especially specialized engineering service provider like the *Radioactive Protection Engineering GmbH* will increase substantially.

For more information the following documentary film is recommended:



planet e: Atomarer Rückbau

(of particular importance is the following film excerpt: 18min. 43s. – 22min. 43s.)

II. Business concept

i. Description of the company

Company name:

RADIOACTIVE Protection Engineering GmbH

Company Logo:

Company description:

The ***Radioactive Protection Engineering GmbH*** will be founded by two shareholders, one nuclear chemist and one nuclear engineer. The company is specialized on the measurements of Radon as well as the measurement of nuclear waste (decision measurement, also called clearance measurement according to the StrlSchV). The company has its own chemistry laboratory for the radiological characterization of samples as well as a mobile laboratory for on-site measurement at the customer. Its location in Jülich is very advantageous to serve the customers at the target market – northwest Germany. The shareholders are highly qualified in the field of nuclear applications, especially Radiation Detection and Measurement, Decommissioning, Nuclear Waste Management and Nuclear Chemistry and are focusing on Consulting, Analysis and the Valuation in the field on Radon measurement and decision measurement. Customers include private and governmental institutions, companies especially nuclear power plant operators and research centers in the field of nuclear reactor technologies as well as private individuals in the field of Radon measurements.

ii. Description of the services provided

a) Radon measurements

Based on the Directive 2013/59/Euratom - protection against ionizing radiation the directive integrates several directives on occupational and public exposure and radiation protection to be repealed in 2018. The Radioactive Protection Engineering GmbH therefore offers different services in the field of consulting, analysis and evaluation in radon measurement.

Especially in the radon analytics the **Radioactive Protection Engineering GmbH** offers modern techniques, beginning with standard-procedures like direct- and exposimeter measurements up to determination of the radon concentration in drinking water or building materials via high-resolution gamma spectroscopy.

The current state of knowledge concerning radon and the associated lung cancer risk make radon measurements in private, commercial and public sector essential. The EU-directive, adopted in 2014, must be implemented into German law by 2018.

The Radioactive Protection Engineering GmbH advises private persons, lessors, architects, builders, property owners, providers of the public institutions and services (nurseries, hospitals, schools, universities, authorities, retirement homes, etc.) as well as employers on how to evaluate the individual risk.

b) Clearance measurements

Based on §29 of the Radiation Protection Ordinance (StrlSchV) radioactive material or movable goods, buildings, soil areas, facilities or parts of facilities which are activated or contaminated may only be used, utilized, disposed of, possessed or transferred if the compliance with the requirements specified in the administrative clearance act has been confirmed.

Clearance according §29 StrlSchV shall be appoved by the competent authority, if the effective dose occurring for members may only be in the order of 10 microsievert. The evidence usually will be given by the so-called clearance measurement according §29 StrlSchV together with the compliance of limit values also defined in the Radiation Protection Ordinance.

The **Radioactive Protection Engineering GmbH** offers the practical implementation of clearance measurements according §29 StrlSchV for radioactive material or movable goods, buildings, soil areas, facilities or parts of facilities which are activated or contaminated as well as the evaluation of this measurements.

Furthermore the **Radioactive Protection Engineering GmbH** offers its customers the supervision of clearance measurements §29 StrlSchV on site at the customer, for example the supervision of the operation of existing free release measurement facilities and guaranteed as a “atomkritischer Sachverständiger” the trustworthiness of the release of radioactive material.

Radioactive Protection Engineering GmbH – Services in the field of clearance measurements:

- Direct measurements of the surface activity concentration for the predestination of the radiological situation.
- Planning of sampling (wipe sampling, etc.).
- Performance of the sampling.
- Evaluation of the samples on-site in the mobile laboratory ("quick-and-dirty" solution) or for the own nuclear chemistry laboratory with high precision.
- Rating of the measurement results according corresponding standards (DIN, StrlSchV).
- (legal) consulting in all questions concerning radiation protection and measurement.
- Supporting in writing letters and applications for the competent authority.

iii. Selection of a legal form for the company

The ***Radioactive Protection Engineering GmbH*** is founded by two shareholders, both with a limited liability and individual responsibilities as defined in the article of association. The decision favored the *company of limited liability* (in German: GmbH) as the legal form for the company because of the following reasons:

- Limitation of the liability on the founding capital of €25,000.
- Only €12,500 have to be raised before registering in the commercial register.
- The partners are not personally liable for the liabilities of either the company or of the other partners.
- The company can be run by the two managing directors who have unrestricted proxy for the company, respectively as defined in the article of association.
- The article of association can be arranged freely and flexibly.
- The company has own legal capacity on entry into the commercial register.
- Hidden reserves can be created by accumulating profits.
- This legal form combines high flexibility with relatively few obligations and the formation procedure of a GmbH is fairly uncomplicated.

iv. Implementation of the services provided

a) Spatial equipment, office, laboratory

Located at the business location Jülich, the competence center Jülich offers offices and laboratories for rent.

The *Radioactive Protection Engineering GmbH* will rent three offices:

and one chemical laboratory:

to perform the work.

b) laboratory equipment, measuring instruments, company vehicles

Mobile Laboratory:

Measurement and laboratory vehicle;
equipped with needed equipment for in-situ measurement of radioactivity and radioactive contamination.

Dose Rate Monitors:

LB 123 UMo - universal monitor for radiation protection applications: one complete system for radiation protection instrumentation. It covers measurement of surface contamination, gamma doserate, neutron doserate and activity. A variety of different contamination detectors enables the measurement of alpha/beta-emitters, beta/gamma-emitters and even of tritium.

Contamination Monitors:

LB 124 SCINT contamination monitor for α- and β-γ-Measurement, based on innovative scintillation technology for radiation protection. It can be employed wherever contamination caused by radioactive substances is encountered and has to be monitored.

LB 165/166 Floor Monitor

The Floor Monitor LB 165/166 is a mobile measurement device with large-area proportional counter tubes for the detection of surface contamination caused by radioactive nuclides.

Activity Measurement:

LB 2046 Portable α-β-Activity Measuring System
designed for general radiation protection applications, such as the measurement of α-, β- and γ-activities in wipe sample or on dusted filters, for the analysis of environmental samples, e.g. waste water after evaporation, and for the detection of activities in small quantities of food sample.

LB 2050 Clearance Monitor
specially designed for clearance measurements which are required for the disposal of radioactive waste with negligible radioactivity in accordance with the German Radiation Protection Ordinance of 2001.

For clearance as non-radioactive substances, nuclidespecific limit values (total activity and specific activity) must not be exceeded. This requires measurement of the sample activity (Bq/g) and the surface contamination (Bq/cm²). The Clearance Monitor LB 2050 is designed for the measurement of the massspecific activity and the surface contamination.

Radon Measurement

RadonMapper

a versatile instrument designed to implement Radon detectionand its quantitative measurement. The unit is highly stable, maintenance free and suitable for continuous radon monitoring campaigns indoor as well as outdoor.

Passive Radon Exposimeter

used for the long-term measurements (3-12 months) in buildings. Thepassive radon exposimeter are cheap , easy to handle and allow a precise measurement of the Radon concentration in buildings after the laboratory examination.

Sited laboratory

Laboratory equipment

The *Radiation Protection Engineering GmbH* will have a full-featured nuclear chemistry lab for the fulfilling of all tasks by their own.

LB 2045 Gamma Spectrometer

a modern gamma spectroscopy system for activity measurements in laboratories. It is easy to operate and provides quick and reliable measurement results which are presented clearly arranged on a large graphical display with touch panel. The instrument is ideally suited for nuclide-specific activity measurements in the radionuclide laboratory.

10-Channel α-β Low-Level Counter with PC-Software AMS

allows simultaneous and separate measurements of low activities for alpha and beta radiation emitting radionuclides with a detection limit of approx. 12 mBq for Alpha (Am-241) and approx. 22 mBq for Beta (Sr-90) (according to ISO 11929; 1 h measuring time).

TRI-CARB Liquid Scintillation Counter

Liquid Scintillation Counting for the determination of contamination in the natural world. The Liquid Scintillation Counter offers highest sensitivity and accurate, quantitative results. The radiometric detection systems is designed for gamma counting, beta counting, and other types of radiochemical detection and measurement.

c) Employees

The company exists of three employees, tasked with the following duties:

Office Administrator

- Accounting
- Offers
- Customer service
- …

Nuclear chemist

- managing director (responsibility defined in article of association)
- lab manager

Nuclear engineer

- managing director (responsibility defined in article of association)
- working on site

III. Market Analysis

i. Client Analysis

Target group definition / potential customers

The target group can be subdivided into two groups as seen below:

a) target group in the field of radon measurement

Public institutions, Private companies as well as Private individuals, e.g.

- Property managers, property marketing, property owner.
- Employees under an obligation to take precautions.
- Radiation protection authorities.
- health and safety at work bodies (institutions).
- building experts, building biologists, building physicists.
- planning and projection offices in the field of new constructions and rehabilitation.
- industrial designer in the field of water plants; treatment of drinking-, process- and industrial waste water.
- …

b) target group in the field of clearance measurement

- nuclear research centers.
- nuclear power plants.

Target Market

Focused on the northwestern areas of Germany and the following client base:

a) in the field **of radon measurement**: areas with high radon concentration:

b) in the field of **clearance measurement**:

ii. Competition Analysis

a) Competitor in the field of Radiation Protection and Radon Measurement

Stoller Ingenieurtechnik GmbH
Location: Dresden / Sachsen
Customers: international clients, public service, private companies
Operation site: International
Services: Radon measurement as well as clearance measurement (according StrlSchV)
Employees: chemists, physicists, engineers

B.P.S Engineering GmbH
Location: Ronneburg / Thüringen
Customers: public service (regional), private companies, private individuals
Operation site: national
Services/Specialisation: natural radioactivity, Radon measurements

Bergtechnisches Ingenieurbüro Geoprax GbR
Location: Rügen und Sachsen
Specialization: indoor radon levels

Ingenieurbüro für Geotechnik und Umwelt GmbH
Location: Bamberg / Bayern
Specialization: geology, radiation protection measurements, Radon measurements

Ingenieurbüro Bergmann
Location: Altötting / Bayern
Employees: 1 engineer
Produkte: analysis of drinking water, Radon measurements, pollutant analysis

Ingenieurbüro Dr. Ehmann
Location: Empfingen/ Baden Württemberg
Specialization: Radon measurements, Radon prevention

b) Competitors in the field of Clearance Measurement:

SHS Ingenieurbüro

Location: Rott am Inn / Bayern
Specialization: clearance measurements

independent consultants like TÜV Süd und Nord

iii. Market size & growth

Market size:

The number of potential clients is equal to the number of all households in Germany (in total round about 40 million) as well as all companies (in total round about 8 million), because of their potential exposure to radon.

In the field of clearance measurements possible clients can be nuclear power plants (8 NPP are still in operation but will be shut down 2022 at least, 9 NNP are still definitively shut down and 16 NNP are under decommissioning) as well as research centers with research reactors and so-called hot-cells.

Market growth:

In the field of radon measurement the new Federal Law on Actions on the Protection of Life or Health of Humans including their progeny against Damages arising from exposure to Ionizing Radiation, adopted in 2018 at latest, will increase the important of radon measurements and lead to a strong market growth.

In the field of clearance measurement it is important to know that only three of the 36 commercial nuclear power reactors are fully decommissioned, 16 are under decommissioning, and 9 nuclear power plants are shut down (decommissioning in planning) respectively 8 nuclear power plants are still in operation. Not mentioned are the so-called research reactors. Overall, 300,000 up to 500,000 tons of material (concrete, metal, plastic, electronic waste, glass, tools, etc.) are produced after the complete decommissioning of **only one** nuclear power plant, therefore a strong market growth can be expected.

Market positioning:

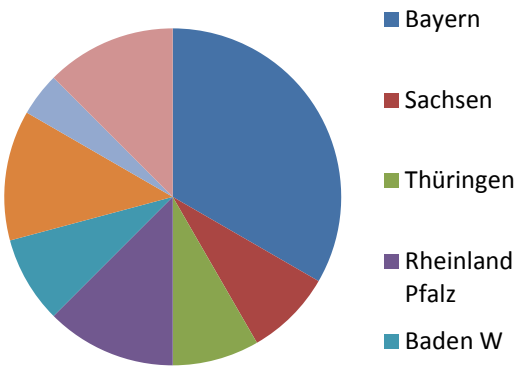
- Specialized in the field of clearance measurement and radon measurement.
- Well educated specialists in the field of radiation detection and measurement.
- Engineering office with own nuclear chemistry laboratory.
- Point of contact for private individuals, companies, state institutions, research centers and nuclear power plant operators.
- Specialized in consulting, measurement, calculation and simulation as well as research and development in all fields of radiation protection.

iv. Results of the market analysis

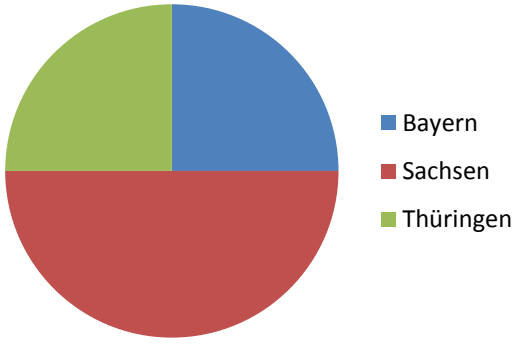
The market analysis shows a polypoly market type (large number of small customers meet small provider on the market); potential customers are described in the client analysis.

Concerning radon measurement most engineering offices are located in Bavaria. In this state of Germany the density of competition is the highest, followed by Rheinland-Pfalz, Berlin and North Rhine-Westphalia. Competitors from Lower Saxony are represented at lowest.

Engineering offices offering radon measurements and clearance measurements are located in Thuringia and Saxony. Thereof three engineering offices can be seen as direct competitors.



The density of competition in the field of clearance measurement is at highest in Saxony. All things considered, 24 engineering offices can be considered as competitors in the field of radon measurement as well as 4 engineering offices can be considered as direct competitors in the field of clearance measurement.



IV. Investment Calculation

i. Calculation of the investment and depreciation costs

	Description	Investment expenditure	depreciation rate (%)	depreciation costs (p.a.)
Offices (three in total)	office furniture	9.000,00 €	10	900,00 €
	edv equipment	7.500,00 €	25	1.875,00 €
Laboratory + Equipment	general laboratory equipment	15.000,00 €	10	1.500,00 €
	Gamma Spectrometer	18.000,00 €	10	1.800,00 €
	10-Channel α-β Low-Level Counter	24.000,00 €	10	2.400,00 €
	Liquid Scintillation Counter	48.000,00 €	10	4.800,00 €
Mobile labor + Equipment	vehicle	50.000,00 €	20	10.000,00 €
	general mobile laboratory equipment	10.000,00 €	10	1.000,00 €
	dose rate monitor	24.000,00 €	10	2.400,00 €
	contamination monitor	4.500,00 €	10	450,00 €
	floor monitor	16.000,00 €	10	1.600,00 €
	Portable α-β-Activity Measuring System	28.000,00 €	10	2.800,00 €
	Clearance Monitor	17.000,00 €	10	1.700,00 €
	RadonMapper	9.000,00 €	10	900,00 €
Additional expenses	notary, registraction	5.000,00 €	0	0,00 €
	share capital for founding the GmbH	25.000,00 €	0	0,00 €
	website, advertising	15.000,00 €	0	0,00 €
	circulatin capital	15.000,00 €	0	0,00 €
	unexpected	25.000,00 €	0	0,00 €
SUM		**365.000,00 €**		**34.125,00 €**

ii. Calculation of the operating costs

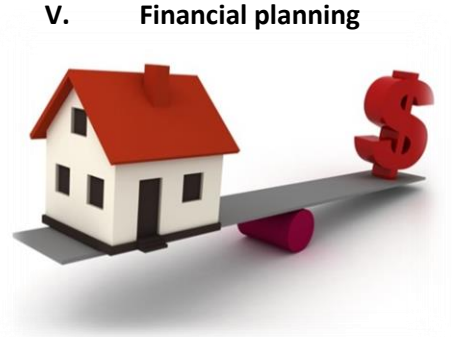
Description	annual operating costs
office rent; inclusive water, gas, electricity	10.800,00 €
laboratory rent; inclusive water, gas, electricity	12.000,00 €
insurances	3.000,00 €
office supplies	4.000,00 €
vehicle (diesel fuel, maintanance)	6.000,00 €
advertising	5.000,00 €
servicing and maintenance of the equipment	3.000,00 €
other costs (tax consultant, etc.)	4.000,00 €
TOTAL	**47.800,00 €**

iii. Calculation of the labor costs

Employee:		office administrator	nuclear chemist	nuclear engineer
gross salary (p.a.)		*30.000,00 €*	*50.000,00 €*	*50.000,00 €*
additional employer contribution:				
healt insurance	7,30%	*2.190,00 €*	*3.650,00 €*	*3.650,00 €*
pension insurance	*9,35%*	*2.805,00 €*	*4.675,00 €*	*4.675,00 €*
unemployment insurance	*1,50%*	*450,00 €*	*750,00 €*	*750,00 €*
nursing insurance	*1,175%*	*352,50 €*	*587,50 €*	*587,50 €*
personal costs (p.a.)		*35.797,50 €*	*59.662,50 €*	*59.662,50 €*

total personal costs (p.a.)	***155.122,50 €***

V. Financial planning



i. Total investment and financing

			percentage
Total Investment		**365.000,00 €**	**100**
sharing			
own capital funds	share holder A	30.000,00 €	8,2
	share holder B	60.000,00 €	16,4
outside financing		275.000,00 €	75,3

The outside financing to finance the 75.3 % of the total investment amounts to 275.000,00 €. Therefore a bank loan over a period of 10 years with a constant annual loan repayment and an interest rate of 5,50% will be used.

ii. Calculation of the financing costs

Year	Balance of debt	Interest rate (%)	Interest costs (p.a.)	Refunding Bank Loan
1	275.000,00 €	5,50	15.125,00 €	27.500,00 €
2	247.500,00 €	5,50	13.612,50 €	27.500,00 €
3	220.000,00 €	5,50	12.100,00 €	27.500,00 €
4	192.500,00 €	5,50	10.587,50 €	27.500,00 €
5	165.000,00 €	5,50	9.075,00 €	27.500,00 €
6	137.500,00 €	5,50	7.562,50 €	27.500,00 €
7	110.000,00 €	5,50	6.050,00 €	27.500,00 €
8	82.500,00 €	5,50	4.537,50 €	27.500,00 €
9	55.000,00 €	5,50	3.025,00 €	27.500,00 €
10	27.500,00 €	5,50	1.512,50 €	27.500,00 €
SUM Interest			**83.187,50 €**	
SUM Repayment				**275.000,00 €**

iii. **Calculation of the billable hourly capacity** (german: fakturierfähige Stundenkapazität)

YEAR	**1**	**2**	**3**	**4**	**5**
calendar days per year	**365**	**365**	**365**	**365**	**365**
./. Saturdays and Sundays	104	104	104	104	104
= Paydays per year	**261**	**261**	**261**	**261**	**261**
legal holidays	10	10	10	10	10
vacation days	30	30	30	30	30
sick days	10	10	10	10	10
= attendance days per year	**211**	**211**	**211**	**211**	**211**
x daily working time (h)	8	8	8	8	8
attendance hours per year	**1688**	**1688**	**1688**	**1688**	**1688**
correction factor (productivity in %)	10	20	30	40	50
productive working hours per year	**168,8**	**337,6**	**506,4**	**675,2**	**844**
number of productive employees	2	2	2	2	2
billable hourly capacity per year	**337,6**	**675,2**	**1012,8**	**1350,4**	**1688**

YEAR	**6**	**7**	**8**	**9**	**10**
calendar days per year	**365**	**365**	**365**	**365**	**365**
./. Saturdays and Sundays	104	104	104	104	104
= Paydays per year	**261**	**261**	**261**	**261**	**261**
legal holidays	10	10	10	10	10
vacation days	30	30	30	30	30
sick days	10	10	10	10	10
= attendance days per year	**211**	**211**	**211**	**211**	**211**
x daily working time (h)	8	8	8	8	8
attendance hours per year	**1688**	**1688**	**1688**	**1688**	**1688**
correction factor (productivity in %)	60	70	80	80	80
productive working hours per year	**1012,8**	**1181,6**	**1350,4**	**1350,4**	**1350,4**
number of productive employees	2	2	2	2	2
billable hourly capacity per year	**2025,6**	**2363,2**	**2700,8**	**2700,8**	**2700,8**

iv. Calculation of the self-costs

YEAR:	1	2	3	4	5
billable hourly capacity (p.y)	337,6	675,2	1012,8	1350,4	1688
correction factor (productivity in %)	10	20	30	40	50

Costs					
depreciation costs per year	34.125,00 €	34.125,00 €	34.125,00 €	34.125,00 €	34.125,00 €
financing costs per year	15.125,00 €	13.612,50 €	12.100,00 €	10.587,50 €	9.075,00 €
labor costs	155.122,50 €	155.122,50 €	155.122,50 €	155.122,50 €	155.122,50 €
consumption costs	47.800,00 €	47.800,00 €	47.800,00 €	47.800,00 €	47.800,00 €
SUM of annual costs	**252.172,50 €**	**250.660,00 €**	**249.147,50 €**	**247.635,00 €**	**246.122,50 €**

costs per hour	**746,96 €**	**371,24 €**	**246,00 €**	**183,38 €**	**145,81 €**

YEAR:	6	7	8	9	10
billable hourly capacity (p.y)	2025,6	2363,2	2700,8	2700,8	2700,8
correction factor (productivity in %)	60	70	80	80	80

Costs					
depreciation costs per year	34.125,00 €	34.125,00 €	34.125,00 €	34.125,00 €	34.125,00 €
financing costs per year	7.562,50 €	6.050,00 €	4.537,50 €	3.025,00 €	1.512,50 €
labor costs	155.122,50 €	155.122,50 €	155.122,50 €	155.122,50 €	155.122,50 €
consumption costs	47.800,00 €	47.800,00 €	47.800,00 €	47.800,00 €	47.800,00 €
SUM of annual costs	**244.610,00 €**	**243.097,50 €**	**241.585,00 €**	**240.072,50 €**	**238.560,00 €**

costs per hour	**120,76 €**	**102,87 €**	**89,45 €**	**88,89 €**	**88,33 €**

v. Definition of the price

The self-costs per hour of service offered are very high in the first three years because of the expected productivity of only 10% up to 30% in the first years.

After the first three years and a higher productivity of 40% (increasing up to 80% in the 8 year = full productivity in praxis) the self-costs per hour of service offered fells below the 200€ threshold and the company becomes competitive.

The Radioactive Protection Engineering GmbH will offer their service for 235€ per hour, based on the results of the market analysis and to cover all expenses of the business to gain profit.

vi. Calculation of the turnover/revenue

Year	Output (h)	price per hour	Turnover/Revenue
1	337,6	235,00 €	79.336,00 €
2	675,2	235,00 €	158.672,00 €
3	1012,8	235,00 €	238.008,00 €
4	1350,4	235,00 €	317.344,00 €
5	1688	235,00 €	396.680,00 €
6	2025,6	235,00 €	476.016,00 €
7	2363,2	235,00 €	555.352,00 €
8	2700,8	235,00 €	634.688,00 €
9	2700,8	235,00 €	634.688,00 €
10	2700,8	235,00 €	634.688,00 €

vii. Cash flow calculation

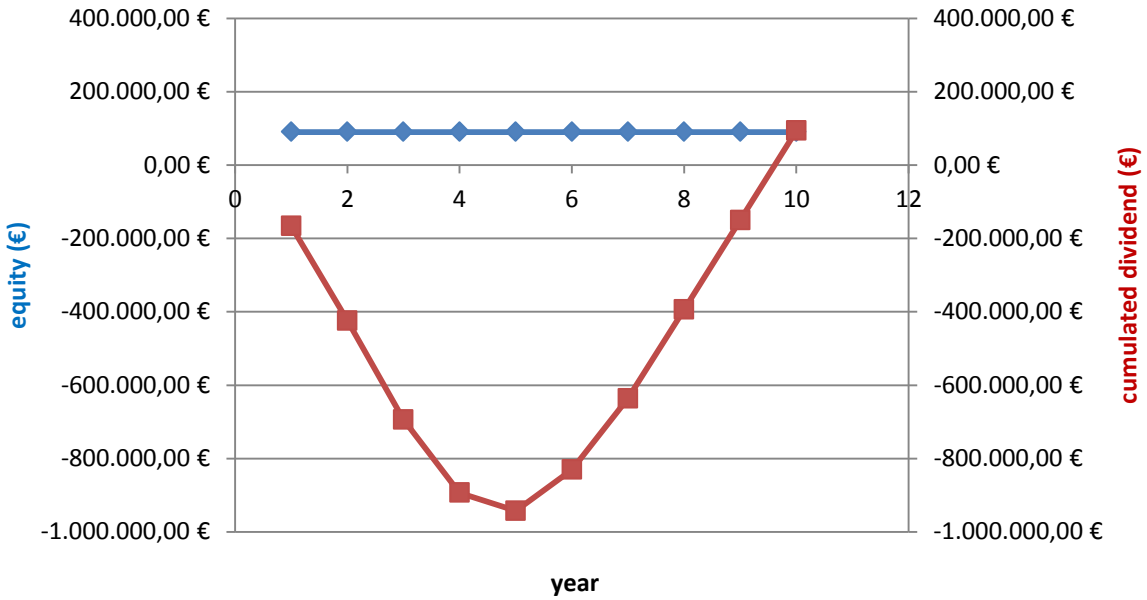
Year	1	2	3	4	5
Sales profits	79.336,00 €	158.672,00 €	238.008,00 €	317.344,00 €	396.680,00 €
Depreciation costs	-34.125,00 €	-34.125,00 €	-34.125,00 €	-34.125,00 €	-34.125,00 €
Labor costs	-155.122,50 €	-155.122,50 €	-155.122,50 €	-155.122,50 €	-155.122,50 €
Operating costs	-47.800,00 €	-47.800,00 €	-47.800,00 €	-47.800,00 €	-47.800,00 €
Financing costs	-15.125,00 €	-13.612,50 €	-12.100,00 €	-10.587,50 €	-9.075,00 €
Loss carried forward	0,00 €	-172.836,50 €	-264.824,50 €	-275.964,00 €	-206.255,00 €
Profit before taxes	-172.836,50 €	-264.824,50 €	-275.964,00 €	-206.255,00 €	-55.697,50 €
Taxes (40%)					
Profit after taxes	-172.836,50 €	-264.824,50 €	-275.964,00 €	-206.255,00 €	-55.697,50 €
Cash-flow (net profit + depreciation)	-138.711,50 €	-230.699,50 €	-241.839,00 €	-172.130,00 €	-21.572,50 €
Repayment credit	27.500,00 €	27.500,00 €	27.500,00 €	27.500,00 €	27.500,00 €
Reinvesting					
Dividend	-166.211,50 €	-258.199,50 €	-269.339,00 €	-199.630,00 €	-49.072,50 €

Year	6	7	8	9	10
Sales profits	476.016,00 €	555.352,00 €	634.688,00 €	634.688,00 €	634.688,00 €
Depreciation costs	-34.125,00 €	-34.125,00 €	-34.125,00 €	-34.125,00 €	-34.125,00 €
Labor costs	-155.122,50 €	-155.122,50 €	-155.122,50 €	-155.122,50 €	-155.122,50 €
Operating costs	-47.800,00 €	-47.800,00 €	-47.800,00 €	-47.800,00 €	-47.800,00 €
Financing costs	-7.562,50 €	-6.050,00 €	-4.537,50 €	-3.025,00 €	-1.512,50 €
Loss carried forward	-55.697,50 €				
Profit before taxes	175.708,50 €	312.254,50 €	393.103,00 €	394.615,50 €	396.128,00 €
Taxes (40%)	70.283,40 €	124.901,80 €	157.241,20 €	157.846,20 €	158.451,20 €
Profit after taxes	105.425,10 €	187.352,70 €	235.861,80 €	236.769,30 €	237.676,80 €
Cash-flow (net profit + depreciation)	139.550,10 €	221.477,70 €	269.986,80 €	270.894,30 €	271.801,80 €
Repayment credit	27.500,00 €	27.500,00 €	27.500,00 €	27.500,00 €	27.500,00 €
Reinvesting					
Dividend	112.050,10 €	193.977,70 €	242.486,80 €	243.394,30 €	244.301,80 €

Total dividend cumulated over 10 years: **93.758,20 €**

viii. Calculation of the dividend, equity profitability and Return on Investment

Year	Equity	Profit after tax	Dividend	cumulated dividend	Interest made on equity (%)
1	90.000,00 €	-172.836,50 €	-166.211,50 €	-166.211,50 €	-184,7
2	90.000,00 €	-264.824,50 €	-258.199,50 €	-424.411,00 €	-286,9
3	90.000,00 €	-275.964,00 €	-269.339,00 €	-693.750,00 €	-299,3
4	90.000,00 €	-206.255,00 €	-199.630,00 €	-893.380,00 €	-221,8
5	90.000,00 €	-55.697,50 €	-49.072,50 €	-942.452,50 €	-54,5
6	90.000,00 €	105.425,10 €	112.050,10 €	-830.402,40 €	124,5
7	90.000,00 €	187.352,70 €	193.977,70 €	-636.424,70 €	215,5
8	90.000,00 €	235.861,80 €	242.486,80 €	-393.937,90 €	269,4
9	90.000,00 €	236.769,30 €	243.394,30 €	-150.543,60 €	270,4
10	90.000,00 €	237.676,80 €	244.301,80 €	93.758,20 €	271,4



➔ **Return on Investment: 10 years**

VI. Marketing

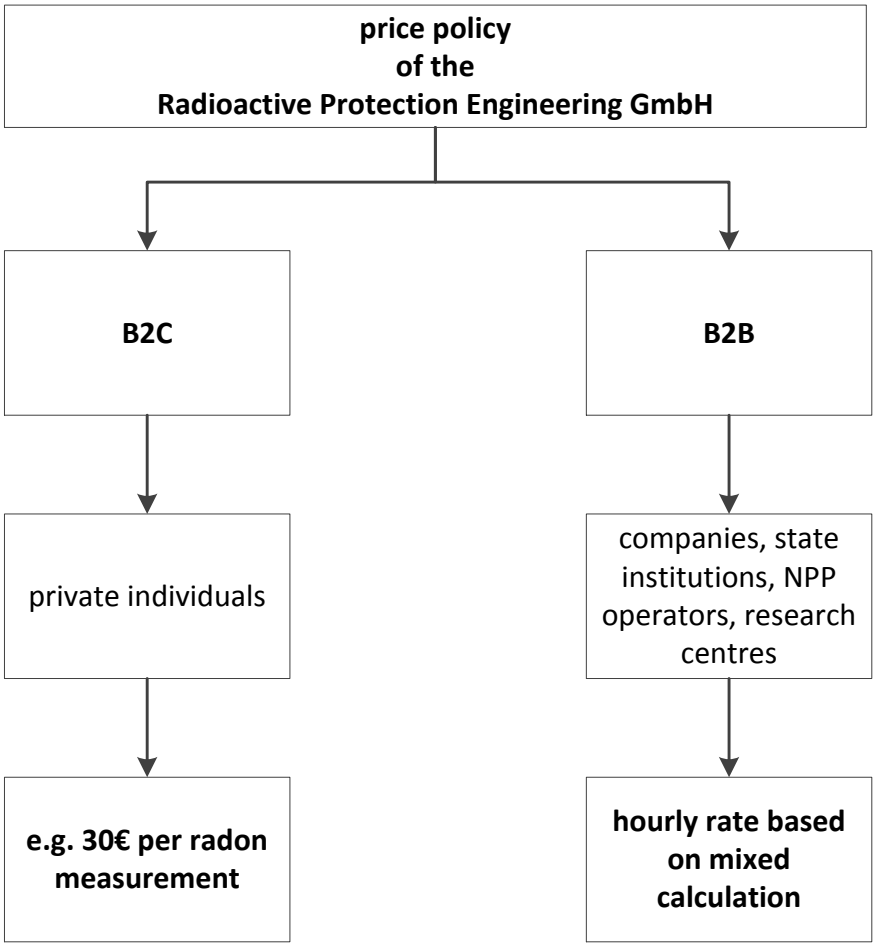
The development of the marketing strategy is based on the four P's of the marketing mix:

i. Product

The **Radioactive Protection Engineering GmbH** is offering services in the field of radon measurement and clearance measurement. The employees are highly qualified and always focused on the customer. To do this, not only professional skills but also social skills are trained. Furthermore the Radioactive Protection Engineering GmbH has its own nuclear chemistry laboratory equipped with the newest radiation detection and measurement equipment to ensure highest quality service. A close cooperation with the Jülich Research Center and the Universities of Applied Sciences in the close surrounding improve the competence and the quality of the company.

ii. Price

With respect to the price policy there will be a distinction based on the target group:



iii. Place

The company location for services is commonly defined by the customers; therefore the **Radioactive Protection Engineering GmbH** has chosen a place located nearby the target market. Sales concentrates on the northwestern area of Germany as well as the nuclear power plants and therefore Jülich was chosen as the company`s location. From Jülich with its geographic location as well as its direct connection to important motorway networks the target market can be reached very well – whereas the competition is concentrating mainly on the southeast of Germany.

Sales is implemented only in the direct way, indirect distribution is not foreseen.

- Company location: D- 52428 Jülich, advantage: closeness to customers and low density of competitors
- Company's marketing arm will be focused directly to the northwestern area of Germany.
- Marketing and distribution is carried out on highly developed partner network, mailings as well as direct contacting.

iv. Promotion

The communication measures include:

- Development of a company logo as well as a Corporate Identity.
- Preparation of business documents.
- Preparation of target-group-specific and product-specific leaflets respectively brochures.
- Preparation of mailings for potential customers.
- Self-presentation on subject-specific fairs.
- Development of a website for company's presentation.
- Image video, company cars with company logo and contact details.

All this actions are developed together with an advertising agency and should be completed at "Go-Live" of the company. The goal is to develop a modern company appearance with the ability to stand out from its competition and to emphasize the quality of the company's service provided.

VII. Conclusion

- ✓ After foundation of the ***Radioactive Protection Engineering GmbH*** the Return on Investment will be achieved after 10 years.

- ✓ In particular the fast establishment of the ***Radioactive Protection Engineering GmbH*** is very important to use the high fix costs, caused by the high personnel costs, as efficient and productive as possible.

- ✓ Marketing are therefore increasing in importance.

- ✓ The big expansion of the market in the next ten years in the field of Radon measurements as well as clearance measurements will support the foundation and establishment of the ***Radioactive Protection Engineering GmbH***.

- ✓ Because of the new radiation protection law in Germany, resulting in a sensitization in the field of radiation protection for the population, engineering service providers like the ***Radioactive Protection Engineering GmbH*** will have very good chances on the market, especially for the next decades until the last nuclear power plant will be fully decommissioned and all nuclear waste will be disposed.

--> The future belongs to those enterprises which are specialized in radiation protection:

RADIOACTIVE
Protection Engineering GmbH