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**Executive Summary**

From fiscal years 2014 to 2016, the market for radiological and nuclear detection has quadrupled to $91M annually[[1]](#footnote-1). RadAlert is a revolutionary new product specifically designed for law enforcement to combat the threat of radiological and nuclear terrorism. RadAlert delivers unprecedented single-user situational awareness from its lightweight, inconspicuous passive radiation alerting and locating system (patent pending). The U.S. Department of Homeland Security has made impressive strides on providing front‑line defense across the country. Procurement of radiation detectors for law enforcement has been and continues to be emphasized.

First in the “secure the cities” initiative, New York City has the most expansive arsenal of radiation detection equipment and on-patrol deployment. In the field, each alarm represents an opportunity to disrupt and thwart a terroristic plot. However even an instrumented police force faces a major obstacle—the overwhelming number of false alarms places an aggravating burden on police force. RadAlert is designed to eliminate two major limitations of existing personal radiation detectors. First, current products must be removed from the officer’s utility belt to analyze and respond to a threat. Second, these devices do not have a guidance system built in; this is a critical component when officers are responding to a threat. RadAlert’s objectives are to inconspicuously communicate the direction of the radiation source and differentiate threats from nonthreat situations without requiring officers to hold a device or look at a display. RadAlert accomplishes these objectives from its patent‑pending analytical logic and guidance system.

RadAlert is the intellectual property of Alert R&D, a Texas-based limited liability company with two founders who each hold 50% of the equity. The two founders have a combined 55 years of radiological science and engineering experience. Holding a doctorate degree in Nuclear Engineering, Dr. Benke is a certified health physicist, entrepreneur in radiation detection and analysis, independent consultant, and FEMA‑trained emergency responder for large-scale radiological incidents. Dr. Hamby holds a doctorate degree in Health Physics, is a Professor at Oregon State University in the School of Nuclear Science and Engineering, and has worked on the front line for 6 years as a patrol officer for the county sheriff. Both hold previous U.S. patents for radiation detection inventions, which were either assigned to their respective employers or academic institutions.

Law Enforcement Agencies represent RadAlert’s initial target market. Existing products for combating terrorist‑related threats are in demand. For instance, the Los Angeles Police Department recently placed a single order of 1,800 radiation detection units, paying $2,898,920 for the lot. Although we are well placed to begin engaging customers and producing prototypes for user testing in 2018, accessing the market is our greatest obstacle currently. Combined with our collective research portfolio and intellectual property protection, user endorsements from prototypes will allow us to garner small business innovation grants and accelerate both development and compliance with the applicable industry standards, necessary for large-scale procurements under the main federally funded program. As the firm grows, we will hire a team of account executives to manage and grow sales.

Ironically, large detector manufacturers fully acknowledge diminished capacities for innovation as well as conducting their own internal research. Within this environment, small businesses spurring innovation and entering the market place will be watched closely. Although some competitor duplication and reverse engineering can be expected, it is more likely that sizeable companies will approach Alert R&D with acquisition offers after respectable profits are realized.

Development of the product is underway. The first prototype is expected by early 2018. The firm currently has a manufacturing chain set up in order to rapidly scale up production should large orders be realized, but this capability has yet to be tested.

We have developed modest financials showing 2,060 units sold in the first five years of operations. The units will be sold at $1,976 generating revenue of $4,070,560. The unit cost is $875 which would create $1,802,500 in variable costs. We estimate our operating expenses to be $1,517,000 which would create $835,000 in operating income. We anticipate being able to significantly lower our unit costs in the future which could potentially significantly raise our profit margin and net income.

RadAlert is currently seeking an investment of $150,000 for a 10% share in the firm’s profits; placing a current valuation of $1.5 million. As specified in our company agreement, individuals with decision-making authority must hold active positions in the company. Outside investors enjoy fractions of the profit and specify when their shares are sold back to the company. The investment will be used to bring in a team to finalize a commercially available product and bring it to market. RadAlert plans to use this investment for the first two years of operations and by our third year to be fully funded through sales revenue.

**Chapter 1: The Company**

Alert R&D, LLC is a technology-based company developing a product, currently named RadAlert, for Law Enforcement Officers (LEOs) and government agents to combat the threat of radiological terrorism. Our first product is a single-user, passive radiation detecting and locating system that alerts the LEO of a potential threat and reduces false alarms from nonthreat sources. This product is built on a patented process of radiological source localization and threat assessment using a hands-free system to provide directional guidance.

RadAlert was founded in order to fill a pressing need that is currently being solved through less sophisticated methods. The Department of Homeland Security says that, “the President of the United States has described nuclear terrorism as the most immediate and extreme threat to global security.” Any type of nuclear attack would have profound negative consequences in both short and long terms; beyond the physical damage and contamination, the psychological damage to affected, as well as nearby, populations and communities could be substantial and long lasting.[[2]](#footnote-2) There are a number of ways that a terrorist organization could launch an attack on the U.S. mainland. Nuclear weapon detonation is the most catastrophic. Use of conventional explosives to disperse radioactive materials, commonly referred to as a radiological dispersal device or dirty bomb, is considered to be the most likely threat. Other methods include sabotaging nuclear reactors, attacking shipments of nuclear and radiological materials, or commandeering radiation generating machines to irradiate unsuspecting members of the public.

Sparked by ingenuity and fueled by personal missions to protect our homeland from radiological terrorism, RadAlert was conceived to be the cornerstone of an innovative new business. This product allows constant passive monitoring for threats while unobtrusive to the Law Enforcement Officer. Being lightweight and operating inconspicuously are key selling points. Even during a radiation alarm, the officer with RadAlert does not concede any tactical advantage to investigate further.

**Current Company Status (as of the 3rd Quarter in 2017)**

Alert R&D, LLC is a Texas-based limited liability company formed in 2017 by two founders who each hold 50% of the corporate equity. The current workforce includes skilled consultants in nuclear engineering, electrical engineering, and business administration. The company has filed a U.S. patent application for its invention and is finalizing a demonstration prototype. Beyond broadening their network, the founders have initiated law‑enforcement customer interviews under nondisclosure agreements and are exploring small business funding opportunities such as those with the U.S. Department of Homeland Security.

**Future Company Plans**

Alert R&D, LLC plans to expand over the next five years through initial investments and eventual revenue from product sales. We plan to open offices in Austin, TX, and Corvallis, OR, to host a team of engineers and account executives to facilitate and manage sales and contracts. After a stable revenue stream is established, we intend to offer expanded capabilities and additional products associated with the corporate mission and our core competencies.

**Founders**

Alert R&D, LLC is operated by two successful professionals at the pinnacle of their careers. The founders have a combined 55 years’ experience in radiological science, detection, and analysis as well as 6 years’ experience in law enforcement. Our backgrounds are directly applicable to this industry, and we are uniquely qualified to develop this product. More importantly, we are passionate about radiation detection, disappointed by the lack of innovation in commercial devices over the past 10 years, and have the resolve to do something about it.

**Dr. Roland R. Benke (co-founder)**

Dr. Roland Benke is an entrepreneur in radiation detection and analysis, independent consultant, certified health physicist, and FEMA‑trained emergency responder for large-scale radiological incidents. Dr. Roland Benke holds a PhD in Nuclear Engineering from the University of Michigan, MEng in Radiological Health Engineering, and a BS in Nuclear Engineering. Leading a team of four, he launched a technology-based startup Videnus LLC in 2015, self-funded the research and development at the University of Texas, created analytical software to characterize threats of concealed radioactive material from portable radiation detector measurements. After debuting the first product within 2 years of formation, he has shifted into promoting technological advancements for homeland security and emergency response. Dr. Benke’s novel techniques have generated images of radiation sources in three dimensions, and his promotional efforts resulted in a project with the Japan Atomic Energy Agency to map “hot spots” of radioactive contamination on the ground surface surrounding the damaged Fukushima-Daiichi reactors from unmanned aerial measurements. He is the lead inventor on four awarded patents and has more than 20 years of experience related to nuclear engineering, radiological health and risk analysis.

**Dr. David M. Hamby (co-founder)**

Dr. Hamby is a nationally recognized professor with more than $8 million dollars in awarded research grants from agencies such as the National Nuclear Security Administration, the U.S. Department of Defense, the U.S. Nuclear Regulatory Commission, the National Nuclear Security Administration and NATO. Currently a Professor at Oregon State University in the School of Nuclear Science and Engineering, Dr. Hamby holds PhD and MS degrees in Health Physics from the University of North Carolina and a BS degree in Physics. He has served as a city councilman and reviewer on dozens of scientific publications; a few examples of these journals include Nuclear Instruments and Methods, Journal of Statistical Computation and Simulation, Nuclear Science and Engineering, and IEEE Transactions on Nuclear Science. He holds two awarded patents for simultaneous beta and gamma spectroscopy and a skin contamination dosimeter. He also has 6 years of experience on patrol as a county sheriff deputy.

**Leadership**

As RadAlert grows the company and leadership structure will reflect these changes. Currently Dr. Benke is the President and Secretary. Dr. Hamby is the Vice President and Treasurer for the company. In the near future they plan to establish a Chief Executive Officer.

**Chapter 2: The Product**

RadAlert enables Law Enforcement Officers on daily patrol to adjudicate radiation alarms and identify threats without compromising their own safety or tipping off suspects nearby. These capabilities are derived from a single-user, passive radiation alerting and locating system (patent pending). Although other natural applications are envisioned for the future, our first product is tailored to law enforcement officers. The system is built on proven detector technology in a configuration that is lightweight and sleek enough to be integrated into the ballistic vests currently utilized by law enforcement. When a threat is detected, the hands-free system will guide the officer directly to the source location. **Because no single-user system exists in the marketplace to deliver this level of situational awareness, the debut of RadAlert represents a paradigm shift in how front-line personnel will respond to and resolve radiation alarms in the field.**

**RadAlert’s Product**

**The Threat**

Recognizing the potential for massive added destruction, long-term disruption, and widespread fear and panic from a terrorist attack involving nuclear or radioactive materials, more large cities across the nation are equipping law enforcement and emergency response personnel with radiation detection equipment. The strong presence of law enforcement officers in our cities not only protects citizens but deters crime. Assigning radiation detectors to officers deploys a preventive radiation and nuclear detection capability on our streets and in our neighborhoods. Think of the major crimes of modern history. Many were solved based on a small clue or incidental infraction that was investigated further. Each radiation alarm represents an opportunity

The U.S. Department of Homeland Security is combatting this threat with large government‑funded procurements of commercially available radiation detectors and deployments to large cities throughout the country technology and sponsorship of research on innovative and enabling technologies[[3]](#footnote-3). To be considered for the large government procurements, a personal radiation detector model must comply with the applicable American National Standard.[[4]](#footnote-4) Compliance with this standard is not difficult but rather translates into an additional task that must be scheduled as a milestone during preproduction operations.

RadAlert’s product is an innovative advancement in the field designed specially to combat this threat. What makes our product unique as a solution to this threat is the ease of use, locating ability and hands free guidance system. When it comes to a terrorist attack, speed is of the essence as the threat must be assessed and neutralized before it occurs.

**Existing Equipment**

Currently there are a range of handheld products that can detect the presence of a radiological threat. Most of these devices are referred to as Personal Radiation Detectors (PRD) or Spectroscopic Personal Radiation Detectors (SPRD).These existing products and the companies who make them are covered more in detail in Chapters 2 and 3. Our analysis of the industry revealed limitations in currently existing products such as the difficulty to manage and use the device in a high intensity and time constrained situation. Another issue was that the responding officer must handle the device in order to analyze its readout. These devices generally have audible and silent alarms, but being worn on the belt makes it possible for the LEO to miss this alarm.

**Current Problems**

Current products provide accurate exposure readings but require users to actively engage and manage these handheld devices. Sight, hearing, and use of their hands are abilities relied on most by individual officers to assess a situation and detect threats, while protecting themselves during the initial encounter. Unfortunately, current detection equipment puts officers at a tactical disadvantage because operation of the radiation detector requires them to look at the device, sometimes hold the device, and monitor changing reading levels. During an alarm, current PRDs require the officer to look at and interpret the readout of a small display and make a decision based on this information. To find a stationary source the officer must constantly check PRD indications while on the move. This additional risk is simply unacceptable because it defies the core training and operational principles ingrained into every officer. A mobile source is even harder to find; current technology often does not provide enough information to find a mobile source before it is out of range. In an actual terrorist situation the officer needs to have his/her hands and eyes free as much as possible and should not be forced to analyze and interpret a changing readout[[5]](#footnote-5).

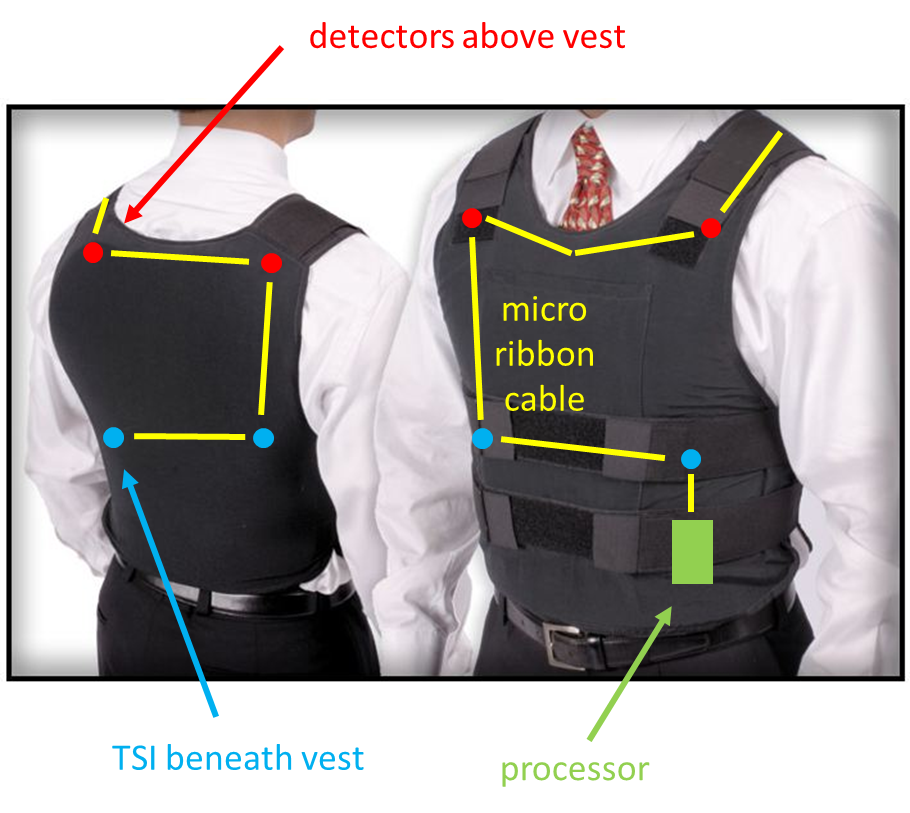
One other issue is that PRDs are very sensitive detectors and can often alarm at low levels, responding to nuclides that are used in medical treatments, naturally occurring radioactivity, or legitimate radioactive sources in transport. An officer must decide on each alarm the nature of the source and the next course of action. With our product, the officer will rule out nonthreating alarms much more quickly and easily.

**RadAlert’s Product and Solution**

RadAlert combines proven detection technology and patented innovations to solve these problems and fill a pressing need for a better solution. Our patented hands-free technology allows RadAlert to detect, locate, and guide the officer directly to the radioactive source. By locating the source, the officer can more readily determine if the alarm represents a threat requiring further action or simply one of the many triggered by a non-threating source of radiation.

Ballistic vests are already standard equipment for uniformed officers, so initial RadAlert models will simply become an integral part of the equipment (Figure 2.1). The device functions perfectly well as a single unit being worn by a Law Enforcement Officer. Later software developments could allow for multiple devices to be combined with GPS to enable city-wide source location capabilities.

**Figure 2.1: RadAlert product design**

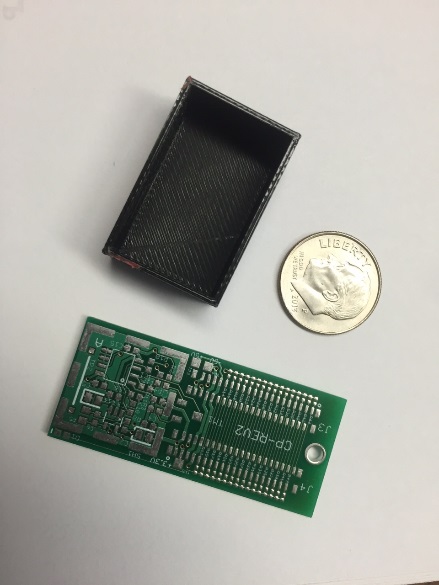


**How it Works**

The RadAlert device is simple to use. At the beginning of each shift, the officer turns the unit on. When the unit is first turned on, all four of the indicators will operate to show that the overall system is ready. The LEO will then go about their shift as normal.

When a detector (Figure 2.2) senses radiation levels above one of the proprietary set points an alarm will occur, the officer receives notification by the directional system, a group of tactile sensory indicators (TSIs) which then point the way to the source. The officer does not have to respond to the unit in any way, allowing them to keep their line of sight and hands free, as the TSIs guide them to the source location. Alert R&D is also developing a training apparatus so that officers will become confident in system use. Our non-radiological training apparatus is a wonderful promotional tool for engaging and impressing customers because it provides realistic customer‑system interactions without low emission rate radioactive sources for demonstration purposes.

**Figure 2.2: Radiation detector circuit board**

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**A Scenario**

An officer is on patrol in a downtown carnival. It’s crowded, nice to see neighbors and fellow citizen enjoying themselves, and the officer’s job to keep it that way. The environment is challenging and loaded with distractions, loud noises, and highly variable lighting (low to very high). *Under these and similar conditions, actual officers are simply unable to hear and see the respective audible and visual alarms from commercially available devices, worn on the duty belt or certain parts of the body, and regrettably officers also complain that vibration sensations are not strong enough to be completely reliable in this environment either.* The temperature is cool, and a clean-cut young man passes by with stroller. The canopy is closed, and his bundle of joy is snuggled underneath a couple baby blankets. It’s a dirty bomb. The officer’s PRD alarms but those cues go unnoticed.

Thirty minutes later, her PRD alarms again as she runs to the detonation site, secures the scene, and renders aid to the wounded. She is smart, well trained, and uses the PRD to convince the arriving paramedics that it is safe enough to enter and remove the wounded (in spite of the radioactive contamination and ambient dose rates at levels one-hundred times greater than natural background—levels that she has never seen before), and proceeds to usher the uninjured to areas with lower dose rates.

Was it the live music, flashing lights, or warmer clothing? Some or all of them? The federal investigators’ discussion continues, while their director is being pressured by the governor for a report on the lessons learned. The fact is an opportunity was missed that night. The investigators check the time stamps of the radiation alarms and fixate on those brief moments half an hour before the chaos when radiation levels gradually rose and then dropped. Now the officer recalls seeing the stroller from afar—he passed no more than 20 yards behind her. How could this happen in a city with thousands of radiation detectors on the street? The units are new, and the officers have been trained. How?

**The Reason & Motivation**

Public acceptance is predicated on current knowledge. There is no negligence when appropriate measures are taken. The public doesn’t know what new capabilities and features are possible until they hit market. In other words, nobody knows that a paradigm shift is coming with how law enforcement will be alerted to and adjudicate radiation alarms.

As a technology developer, we know what is possible. In fact, it’s our business to know. Moreover because we know, we are obligated to do something about.

Compelled to minimize missed opportunities on the front lines, we see the paradigm shift and are pushing hard to make it a reality, one unit at a time. “Avoid headlines, catch it at the front line.”

**Basics of Ionizing Radiation**

**Radioactivity**

Radioactivity is defined as the emission of subatomic particles (e.g., alpha, beta, neutrons) or ionizing electromagnetic radiation (e.g., X-rays, gamma rays) caused by the spontaneous transformation of atomic nuclei. The activity of a given radioactive (unstable) substance is the rate of nuclear transformation. Nuclear transformation is commonly referred to as radioactive decay due to characteristic emissions of subatomic particles and electromagnetic radiation (hence “radioactive”) as the nucleus transforms into a different element (hence “decay”)[[6]](#footnote-6).

**Ionizing Radiation**

Radiation is said to be ionizing when it is energetic enough to ionize atoms and liberate electrons from their atomic shells, the. In principle, ionizing radiation can be harmful to humans due to cellular damage and increased free radical production in the body. When the extent of damage exceeds the capacity of the body to repair itself from a high radiation dose, the loss of cellular function from unrepaired or incompletely repaired cells progresses to impaired tissue function, observable health effects, and clinical symptoms. When the received radiation dose is too small to induce these deterministic health effects but sufficient enough to overwhelm repair mechanisms that lead to inhibited cellular growth regulation, the radiation dose is commonly attributed to small increases in the incidence rate (or probability) of cancer, compared to “natural” causes.

Although many other forms of radiation are around us daily, the specter of harm and fear is firmly affixed to ionizing radiation. Commonplace examples of nonionizing radiation are radiowaves, microwaves, visible light, and infrared radiation. Ultraviolet radiation falls at the edge of the ionization threshold. Sunlight includes ultraviolet radiation. Due to its lower penetrating ability, ultraviolet radiation doesn’t penetrate beyond the layers of skin but rather deposits all of its energy in the skin. Too much unclothed exposure to sunlight leads to ultraviolet radiation burns of the skin, more commonly referred to as sunburns. Beyond sunburns, ultraviolet radiation exposure is attributed to an increased incident of skin cancer. The balance is delicate. Lotions applied to the outer dead layers of skin, called the epidermis, noticeably increase the absorption of ultraviolet radiation by the epidermal layers, thereby protecting the underlying, sensitive layers of the dermis[[7]](#footnote-7).

**Imminent Threat**

Considering the variety of radiation types, conventional sources, opportunities for diversion, and extent of negative impacts from malicious uses, radioactive materials emitting ionizing radiation in the form of gamma rays and x rays represent the most likely threat due to their notorious ability to penetrate the human body and damage highly sensitive internal organs from simply approaching high emission rate (high activity) sources. Unfortunately, lotions and clothing provide no protection.

Although neutron exposure can also be harmful to human, neutron emission is a known signature of and “smoking gun” for special nuclear material. Nuclear weapons are made from special nuclear material. The ominous danger from a nuclear weapon attack needs no further explanation.

For these reasons, the worldwide campaign on preventive radiological and nuclear detection concentrates on gamma rays, x rays, and neutrons[[8]](#footnote-8). Instruments in this market sector are sold for **preventive radiological and nuclear material detection**. Even under the Secure the Cities initiative, neutron detection is a specialized case. Receiving communities are primarily tackling the gamma-ray and x-ray detection challenge. Market forces confirm that RadAlert’s approach to enter the market without neutron detection is not only well founded but also supported by several other new radiation detector manufacturers. After achieving market validation and growth with RadAlert, more of our attention can be devoted to neutron detection.

**The Mission: Preventive Radiological and Nuclear Material Detection**

Detecting radiological and nuclear material requires sensitive instruments, especially when the location of a radioactive source is unknown and detectors are not placed next to the source. In many situations, shielding placed around radiological and nuclear materials significantly reduces radiation levels outside the shielding compared to those from the unshielded material. With shielding, these materials can be handled (e.g., physically moved) more safely without subjecting individuals to much larger radiation doses. Because radiation levels outside the shielding containers are significantly reduced, it is also more difficult to detect the presence of shielded sources. In other words, shielding can be used to conceal the radioactive and nuclear materials from detection. The mission of preventive radiological and nuclear material detection is to detect and interdict unauthorized radiological and nuclear material and thereby prevent adverse consequences from their unauthorized uses.

**Natural Background Radiation Complicates Threat Detection**

Natural background radiation can be found in air, water and soil. This radiation occurs from terrestrial and cosmic sources Personal radiation detectors are sensitive instruments capable of registering background radiation. Because the detection signal from a radiation source diminishes a greater distances from the source, personal radiation detectors strive to distinguish the small signals from additional sources of radiation from the variable composite signal of natural background that fluctuates based on location, the time of day, and season. It is important that detectors used for preventive detection and intervention do not trigger constantly due to fluctuations in the naturally occurring background (Lilley, 2010).

Trigger levels or set points of PRDs allow for fine tuning of instrument sensitivity and alarm thresholds. Don’t want to be bothered by numerous daily alarms from natural background variations that burden your workday with repeated investigations ending without finding any radioactive sources above background? Adjust the set point higher, but set it too high and the instrument will also not alarm and simply miss a more scenarios when radioactive material is actually present. Typical thresholds or trigger levels are set high enough to result in acceptably low rates of false alarms (i.e., nuisance alarms) but low enough to have a relatively high reliably for detecting the presence of radioactive material above background.

**Radiation Dose**

Radiation dose (also called Absorbed Dose) is a basic quantity used to describe energy absorption in a given material. Dose is the mathematical ratio of total absorbed energy to the mass of material in which the energy is absorbed. The units of absorbed dose include the rad and the Gray (Gy). One gray equals one joule of energy absorbed in one kilogram of matter (Lilley, 2010). One rad is 1/100th of a Gray.

**Exposure**

Exposure is a quantity that describes the charge created as electromagnetic radiation traverses air. It is measured in units of Roentgen (R) or charge per kilogram of air, C/kg. In strict adherence to its definition, exposure is defined only for air and only for electromagnetic radiation (gamma rays and X rays). For notational simplicity, a single term gamma rays is used hereinafter for both gamma and x rays[[9]](#footnote-9).

**Personal Radiation Detectors (PRD)**

Personal Radiation Detectors (PRDs) are small radiation detectors with at least two alarm levels. Designed for radiation fields with very low to moderate dose rates, general‑purpose PRDs record current radiation levels, from the presence of natural background and the presence of additional radioactive sources, and provide real-time indications of absorbed dose rate for worker or public safety. For high and very high dose rates that might be encountered during emergency situations, extended range units alleviate the inherent lack of additional information provided by an off‑scale indication from general‑purpose PRDs and also maintain functionality for preventive radiological and nuclear detection. For extremely dangerous radiation fields, personal emergency radiation detectors and monitors provide full functionality for the highest ranges of dose rates and harshest environments, but these devices do not possess the.

PRDs detect gamma rays, but specialized units detect both gamma rays and neutrons. Typically clipped to an individual’s belt, PRDs are used by officers and agents in law enforcement, border protection, and homeland security. For its higher unit cost, a spectroscopic PRD (SPRD) differentiates the amount of gamma-ray energy deposited, which enables nuclide identification as well as enhances the detection, identification, and categorization of radioactive material present above natural background[[10]](#footnote-10).

**RadAlert**

Initial RadAlert models will be classified as PRDs. Because the RadAlert design is expandable, building in enhanced operational features and crossing over into adjacent market areas, which may involve reclassifying future models, will be considered during the growth phase of the company.

Initial RadAlert models will be manufactured with scintillation detector technology. As ionizing energy is absorbed in the scintillator, a flash of light is produced that is proportional to the amount of energy absorbed. This internal light is then collected and analyzed. The RadAlert device is designed to respond to the rate at which the light flashes are generated.

**Chapter 3: Market and Industry Analysis**

RadAlert is being developed for law enforcement officers in order to combat the threat of nuclear related terrorism. Even though the company is initially targeting a specific market, the product and its underpinning of intellectual property and advanced technologies relate to three large, well‑established industries, which provide tremendous opportunities for future growth. The first is the very large nuclear and radiation industry that encompasses electrical power generation, academia, geology, the medical field and radiation detection, to name a few. The second major market is homeland security and law enforcement, both of which rely heavily on radiation detection to keep the public safe from the threats of terrorist attacks with nuclear and radiological materials[[11]](#footnote-11). The third major market that RadAlert will operate in is the software, hardware and technology industries. Within this market, RadAlert represents wearable technology and personal guidance systems.

Our initial target market will focus primarily on the radiation detection industry. The overall radiation detection industry is shaped by 4 to 5 major competitors who generally offer a range of products and find their niche in other large industries. For instance, Mirion Technologies is largely involved in the nuclear industry and recently acquired Canberra Industries, a radiation detector manufacturer. Offering imaging devices for numerous different applications, FLIR is a major competitor with radiation detection representing a very small part of their product offerings. Thermo Fisher Scientific has a strong presence in the PRD market but also offers products for applications in the life sciences, academic, research, and medical fields.

In addition to these large companies, a number of smaller companies focus on niche areas in the detection market. Many of these smaller firms focus primarily on detection related devices that fill a particular industry need. Our market analysis found that many of these firms started in academic research and often work closely with government agencies during the research and development of new products.

Overall, the industry is driven by the need for innovation, both domestically and internationally. Products enabling constant surveillance and detection of potential radiological threats are in demand. In this market, innovation is derived from academic research, internal business research and development, and government-funded grants awarded to businesses operating in the industry.

**Initial Target Market**

RadAlert offers operational benefits to law enforcement, homeland security, border security, and transportation safety. These target markets are both healthy, as evidenced by recent purchases and the urgency of escalating US Government investments, and accepting of new technologies to satisfy mounting pressure from end users for more advanced PRDs. RadAlert will initially focus on domestic markets, but growth into international markets can be expected after the product’s value to customers is established.

The law enforcement market is the entry point for RadAlert due to a pressing need for increased security from terrorist and radiological threats by governmental agencies, seeking and investing in the newest technology and RadAlert’s intrinsically superior mode of operation for these customers compared to existing systems that are not purpose designed [[12]](#footnote-12).

**Initial Target Market Size**

RadAlert’s initial target market is law enforcement officers, particularly sworn officers who actively patrol and protect citizens across the United States. The market size was determined from a comprehensive report compiled by the U.S. Department of Justice. Reliable data from 2012 were used in this analysis even though the overall market size has grown since then. Specifically, the Annual Survey of Public Employment and Payroll (ASPEP) provides a detailed overview of sworn officers by state, as reproduced in Appendix 3.1. Although other front-line agents from the U.S. Customs and Border Protection, U.S. Department of Homeland Security, and U.S. Coast Guard represent an appreciable market share, this analysis is dedicated to law enforcement officers covered in the survey [[13]](#footnote-13).

Based on 625,668 total sworn officers across the 50 States as an initial estimate for the overall market size, Table 3.1 indicates that capturing 2% of the market equates to nearly $25 million in revenue. In other words for every 100 officers, a department would have two deployable detectors on average. Currently, radiation detector deployment to officers has concentrated on large cities, borders and ports of entry, and communities along frequently traveled routes for nuclear and radioactive material transportation. Although jurisdictions with radiation detection equipment typically exceed 2% coverage, many others do not possess and maintain up-to-date radiation detection equipment.

**Table 3.1:** Market Size, Unit Sales and Revenue (0.5% to 2% of Market)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Officer Utilization** | 0.50% | 1.00% | 1.50% | 2.00% |
| **Total Units Sold** | 3,128 | 6,257 | 9,385 | 12,513 |
| **Total Revenue** | $6,100,263 | $12,200,526 | $18,300,789 | $24,401,052 |

In Table 3.2 we see a higher estimate of sales that extends to 12% of officers being equipped with one of our units. This would put the firm at almost $150 million in revenue. To determine the usage we can analyze the existing Los Angeles purchase of 1,800 units. For nearly 10,000 officers, their utilization rate stands at around 18% or 18 units for every 100 sworn officers.

**Table 3.2:** Market Size, Unit Sales and Revenue (4% to 12% of Market)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Officer Utilization** | 4.00% | 6.00% | 8.00% | 10.00% | 12.00% |
| **Total Units Sold** | 25,027 | 37,540 | 50,053 | 62,567 | 75,080 |
| **Total Revenue** | $48,802,104 | $73,203,156 | $97,604,208 | $122,005,260 | $146,406,312 |

This initial market analysis serves as input to our early sales forecasts including a high end cap on estimated sales. Our financial estimates are significantly lower than the high end market estimates with our estimated five years sales forecast being far less than 1% of the potential domestic market. Our potential market capture estimates are very low and we will actively pursue higher sales volumes. These estimates also do not take into account international sales or the expansion of new product lines or other product uses. For example, next stage markets could include border patrol officers or use by the military.

**Market Analysis of Radiation Detection Industry**

A detailed analysis was conducted on firms operating in the radiation detection industry. To be included in this market research, the firm either offered a personal radiation detector or had the organizational know how to potentially develop one in the near future. This analysis found more than 70 firms that were operating in this market, and a summary of these firms is provided in Appendix 3.1. Of these firms, only 16 offered a competitive product. Chapter 4 presents an analysis of these firm’s individual product lines.

**Firm Analysis**

To be considered as a current competitor, a firm must offer a personal radiation detector (PRD) or a spectroscopic personal radiation detector (SPRD) that are small and durable for use by active-duty law enforcement officers. Most firms analyzed were clearly not competitors, but approximately nineteen possess the organizational knowhow to could create a PRD or SPRD. Of those organizations with capabilities to potentially develop a competitive product, most are not high level threats because they mostly operate in entirely different subindustries such as medical dosimetry, electrical power production, and large-scale detector systems. Nine firms were seen as higher level threats with a product that could potentially be used as for Homeland Security (Table 3.5).

**Table 3.5:** RadAlert Industry Analysis

|  |  |  |
| --- | --- | --- |
| **Competitors** | | |
| Yes | Offers Competitive Product | 9 |
| Potential | Has Technological Capability to Develop Product | 19 |
| No | Most Likely Not Competitor | 49 |

The analysis of 77 firms operating in the nuclear industry showed that they operated in multiple industries. Figure 3.2 shows the diverse range of industries that they are part of. One point of note is that detector companies were listed separately but detectors are usually purchased for their use in specific industries, like the medical or research industries.

**Figure 3.2:** Market Analysis by Industry of Similar Firms

Of the firms analyzed more than 60% could be considered a large company (Figure 3.3). Generally these larger firms offered a diverse range of products with nuclear related equipment a part of their product offerings. For instance, Toshiba is a large international company that offers a range of medical products some of which utilize nuclear or radiation based technology. Another important part of the industry analysis is that many of these firms operate across multiple industries.

**Figure 3.3:** Estimated Size of Firms in Industry

The majority of firms analyzed operate in the detector, nuclear or medical business (Figure 3.2). A few of the firms are specialized distributors without engineering or manufacturing capability that simply sell detection products (**Appendix 3.2**:). Some of the firms specialize in Homeland Security products and receive large grants, including single development grants of a few million dollars or more. Regardless, there is a high degree of overlap; for instance a company primarily operating in the nuclear energy industry may also provide products to academia and research customers. Detector firms specializing in dosimetry that sell products to the medical and electrical power generation industries serve as additional examples.

**Short Term Future Market Expansion**

A number of markets not analyzed would be fairly easy for RadAlert to move into during its early stages. These markets are accessible with our current product and technological capabilities. Because innovation is a hallmark of Alert R&D, the company will be regularly assessing new market areas and tailoring existing products for new customers.

**Border Security**

Multiple types of detection systems are currently utilized to secure the U.S. borders. The U.S. Department of Homeland Security (DHS) is actively working to enhance security, and our product could be adopted by them in the future to monitor borders. Some of the firms examined already manufacture radiation detection systems for inspecting freight and vehicles, but they are large stationary devices, not intended for rapid localization and adjudication of potential threats from roaming surveillance or portable survey measurements.

**Government Grants**

Not considered as a traditional market, government grants are an incredibly important opportunity. These grants span a large number of needs across multiple industries. We will pursue grant opportunities that fit our organizational capabilities. In 2016, DHS issued multiple grants and awards to radiation detection companies. Four of these grants totaled more than $17.5 million and were awarded to companies for developing detection technologies related to specific DHS missions and applications.

**International Markets**

Because RadAlert embodies a paradigm shift in user operation, international interest will pique after the product’s value is demonstrated in the United States. We would likely expand into Europe next and globally from there, as the firm begins hires staff with experience in handling international contracts and sales in those locations.

**Chapter 4: Competitor Analysis**

RadAlert’s product is unique. No other single-user product addresses the inherent challenges of law enforcement applications. The patented hands-free operation and personal guidance capabilities are new to this field and is unavailable in competitor’s products.

From a broad analysis of our competitors, sixteen firms currently offer about sixty products and models that could be selected instead of RadAlert. It is important to note that while there are a lot of product lines; these products are all very similar. Most of their differences are generally associated with typical specifications for detection efficiency, durability, detection capability, user interface, and network capabilities.

**Product Analysis**

Sixty products, offered by 16 firms (Table 4.1), cover the available range of Personal Radiation Detectors, Spectroscopic Personal Radiation Detectors, or handheld radiation detectors. DHS guidelines and regulations were utilized when analyzing products. A complete summary of all products is found in Appendix 4.1.

PoliMaster, Thermo Fisher Scientific, and Mirion Technologies offer the largest range of radiation detection models. Of the sixteen firms, eight firms offer a product considered to be serious competition. Many products are very similar and offer slight variations related to factors such as gamma-ray detection sensitivity, scintillator type, durability rating, and battery life.

**Table 4.1:** Total Competitor Product Offerings

|  |  |
| --- | --- |
| **Company** | **Total Products** |
| Polimaster | 23 |
| Thermo Fisher Scientific | 10 |
| Mirion Technologies | 5 |
| Arrow Tech | 3 |
| FLIR | 3 |
| RAE Systems | 3 |
| Sensor Technology Engineering | 3 |
| Berkeley Nucleonics Corporation | 2 |
| Bubble Technology Industries, Inc. | 1 |
| Canberra | 1 |
| Environmental Instruments Canada | 1 |
| Kromek | 1 |
| Passport Systems | 1 |
| Radcomm Systems | 1 |
| Saphymo | 1 |
| Technical Associates Nuclear Instruments and Systems | 1 |

**U.S. Department of Homeland Security Product Analysis**

The U.S. Department of Homeland Security (DHS) recently conducted a product analysis of PRDs and SPRDs for active threat monitoring[[14]](#footnote-14). Each firm analyzed by DHS was also included in our analysis, but DHS was more restrictive, examining only eight potential firms. DHS identified twenty potential detectors currently on the market meeting basic requirements for PRDs or SPRDs (Table 4.2).

**Table 4.2:** Total Competitor Product Offerings from DHS Research Study

|  |  |  |
| --- | --- | --- |
| **Company** | **Detector Type** | **Total Products** |
| PoliMaster | PRD | 4 |
| Mirion Technologies | PRD | 1 |
| Technical Associates Nuclear Instruments and Systems | PRD | 1 |
| RAE Systems | PRD | 1 |
| Sensor Technology Engineering | PRD | 1 |
| Thermo Scientific | PRD | 3 |
| **Total PRD** | **PRD** | **11** |
| FLIR | SPRD | 1 |
| Mirion Technologies | SPRD | 1 |
| PoliMaster | SPRD | 4 |
| RadComm | SPRD | 1 |
| Thermo Scientific | SPRD | 2 |
| **Total SPRD** | **SPRD** | **9** |
| **TOTAL DETECTORS** | **PRD + SPRD** | **20** |

Because many of RadAlert’s enhancements exceed the basic operational requirements stipulated by government agencies, our competitive landscape will most likely fit the narrower field seen in Table 4.2. As previously stated, RadAlert’s hands-free operation is unique among the group and a welcomed attribute to many law enforcement officers who are already equipped with PRDs. Although RadAlert’s personal guidance system for intuitive stealth notification and localization of radiological sources has the potential to be disruptive, this government-funded market responds more slowly compared to mainstream consumer-based markets. The slower market response has been factored into our analysis to avoid overly optimistic growth projections.

**Product Cost**

RadAlert will be sold at a competitive price. Pricing in the detector industry is subject to some level of fluctuation for large-scale contracts. Many firms do not list product prices, but instead ask the consumer to contact the firm for pricing. Utilizing data from the DHS study (Table 4.3), we found that the average cost of a PRD was $3,478 and the average cost of an SPRD was $5,237. The average for detectors of both types was $4,270.

**Table 4.3:** Average Detector Costs from DHS Study

|  |  |  |
| --- | --- | --- |
| **Detector Type** | **Average Cost** | **Total Detectors** |
| Average PRD Cost | $3,478 | 11 |
| Average SPRD Cost | $5,237 | 9 |
| **Average Detector Cost** | **$4,270** | **20** |

**Competitor Analysis Conclusion**

In conclusion, RadAlert will enter its target market in a strong position to become the device of choice for law enforcement officers. RadAlert’s intrinsically superior mode of operation will make it attractive within the law enforcement community. Beyond that incentive, RadAlert is expected to debut with fewer features compared to more mature devices. Because simplicity and ease of use are highly regarded in this particular market, fewer features will not draw the same cause for concern. Beginning before and continuing after RadAlert’s release, we will poll anticipated customers and actual end users for feedback on essential and desired features for future models.

**Chapter 5: Overall Schedule (5 year plan)**

This chapter provides a brief overview of RadAlert’s plans to bring our product to market and grow revenue. There are a number of goals we will work towards including finalizing our customer ready product, protecting our intellectual property, securing an investment and meeting or exceeding our sales goals. Another important part of firm growth over the next five years will be the ability to build a team of talented and driven engineers, sales, leadership and business staff.

Our current sales estimates put our five year total at 2,060 units. However, it is also possible that the firm may achieve growth more rapid then this due to shifting political trends or global events that lead to an increase demand for deterrents to nuclear terrorism attacks. In that case, the firm would expand to accommodate the higher production and servicing volume.

The schedule that is shown below is a guideline that is dependent on many factors, but most of the major milestones will need to be met for us to achieve long term success. In our Operations Plan we lay out our strategy of how we would hire and build a team to handle varying levels of growth.

Our overall goal is to a pursue a strategy of revenue-driven expansion. The founders have already adopted a lean business model by bootstrapping the entire product development process, all hiring, contract labor and legal and intellectual property aspects of the company. Given the formidable research backgrounds of both founders and rapid progress made to date with prototype development, government-sponsored small business projects may obviate the need for outside investments during the first 5 years of development. Additional financing might be considered if it allows us to realize other markets, new product lines, or new manufacturing enhancements provided that those outcomes do not significantly raise long-term overhead costs.

**RadAlert Key Milestone Categories**

Major milestones are outlined in five categories: product development, legal and intellectual property, investment, staffing and hiring, and sales.

**Product Development**

Product development milestones include developmental achievements (and costs) for current and future products including research and development goals and manufacturing efficiency. As a product driven company these goals and timelines will be crucial to firm operations and diligence will be taken to track progress. We plan to utilize technology based products to streamline development and team interaction. This includes allowing engineering teams to operate with software they find the most effective.

**Legal and Intellectual Property**

In light of its multiple end uses, legal and intellectual property milestones are essential to the protection of RadAlert. By securing a patent and employing commonsense approaches to protect against the reverse engineering of our products, our entry into this highly specialized market will leave large barriers for our competitors to overcome before offering a compatible product. If we decide to pursue international markets, international patents could provide an additional competitive advantage. We except that international patents and overseas sales could result in higher costs so will initially keep our focus on the domestic market. The added challenge of penetrating into international markets might create an option for licensing the intellectual property to companies who are more established in specific international markets.

**Investment**

Pursuit of government-sponsored research and development projects is advantageous because those investments do not dilute our equity in the company. If RadAlert secures an outside investment, achieving the intermediate performance metrics and providing the anticipated return on investment to our stakeholders become important milestones.

**Staffing and Hiring**

Staffing and hiring goals will be very important to the overall success of RadAlert. For this reason we plan to focus on setting and meeting goals that will foster a highly qualified and motivated team who align with our vision. Our first key milestone will be bringing in a CEO who will oversee the execution and strategic direction of the firm. The next milestones will include building a team of engineers and account managers. Finally, when we expand into our first office we will also bring in business related staff to help with hiring, administrative and company related activities.

**Sales Goals**

The ability to create relationships with future customers and secure both small and large contracts will be crucial to our success as a company. Sales goals will be used to make sure we are doing everything possible to increase revenue. However, RadAlert plans to pursue a sales strategy built on relationships and trust and will always put the customer first. One of these goals is turning initial customers into repeat customers.

Our sales goals will include rewarding our account executives for meeting goals for current sales and for establishing long term relationships with customers. A few examples of short term goals include the live deployment of a few detectors by law enforcement in smaller and larger towns.

**Financial**

Financial goals will be used to track and encourage growth, analyze performance and insure the ability to meet short term financial needs. Many of these will be tracked and measured utilizing traditional accounting methods and financial ratios. A few important areas we are already using include firm revenue, operating margin and net profit margin. We will also use current industry standards to benchmark our performance. Our current two largest goals include creating and growing revenue and operating efficiently. These goals are significant for firm growth, in that if we do not meet financial goals other goals will slip in the schedule.

**Facilities**

One of RadAlert’s first goals is to secure office space. Later the firm may establish an overseas location to assist with European sales, but our five-year plan focuses on US operations.

**RadAlert Key Milestone**

RadAlert has a number of key milestones that will build upon each other. Milestones (Table 5.1) are distributed according to the year and fiscal quarter in which we anticipate these happening based on projected sales. As stated previously, these milestones build on each other and given higher sales it is possible this timeline becomes condensed to a shorter duration than five years. It is our goal to grow as quickly as possible, but to do so in a fiscally responsible manner.

**Table 5.1:** RadAlert Key Milestones

|  |  |  |  |
| --- | --- | --- | --- |
| **Year**  **(Units sold)** | **Task** | **Category** | **Quarter** |
| Year 1  (preproduction,  no sales) | Company formation | Leadership | Quarter 1 |
| Interview primary customer | Product Development | Quarter 2 |
| File patent application | Legal and IP | Quarter 3 |
| Business plan | Investment | Quarter 3 |
| Mockup testing | Product Development | Quarter 4 |
| Mockup demonstration to federal government | Sales Goals | Quarter 4 |
|  |  |  |  |
| Year 2  (60 units sold) | Apply for federal government funding | Investment | Quarter 1 |
| Prototype completed | Product Development | Quarter 2 |
| National standard compliance | Product Development | Quarter 3 |
| Prototype demonstrations to state agencies | Sales Goals | Quarter 3 |
| Prototype demonstrations to local precincts | Sales Goals | Quarter 4 |
| Deliver first products | Sales Goals | Quarter 4 |
|  |  |  |  |
| Year 3  (200 units sold) | Apply for federal government funding | Investment | Quarter 1 |
| Hire Engineer-Electrical (1) | Staffing and Hiring | Quarter 1 |
| Fabricate loaner models | Product Development | Quarter 1 |
| Field tests of loaner models | Sales Goals | Quarter 2 |
| Receive federal funding | Financial | Quarter 3 |
| Firm moves into office | Facilities | Quarter 3 |
| Hire Account Manager (1) | Staffing and Hiring | Quarter 3 |
| Firm becomes profitable | Financial | Quarter 3 |
| Hire Sales Specialist (1) | Staffing and Hiring | Quarter 3 |
| Product refinement for production | Product Development | Quarter 4 |
| Deliver small orders | Financial | Quarter 4 |
|  |  |  |  |
| Year 4  (600 units sold) | Apply for federal government funding | Investment | Quarter 1 |
| Sales reach breakeven point | Sales Goals | Quarter 2 |
| Hire Production Engineer (1) | Staffing and Hiring | Quarter 2 |
| Increase production | Product Development | Quarter 2 |
| Receive federal funding | Financial | Quarter 3 |
| Hire Account Manager (2) | Staffing and Hiring | Quarter 3 |
| Hire Administrative Assistant (1) | Staffing and Hiring | Quarter 3 |
| Large-scale field testing (externally funded) | Product Development | Quarter 4 |
| Deliver medium orders | Sales Goals | Quarter 4 |
| Firm becomes self-sustaining from sales | Sales Goals | Quarter 4 |
|  |  |  |  |
| Year 5  (1200 units sold) | New generation model development | Product Development | Quarter 1 |
| Hire CEO | Leadership | Quarter 1 |
| Hire Account Manager (3) | Staffing and Hiring | Quarter 1 |
| Hire Engineer-Software (2) | Staffing and Hiring | Quarter 2 |
| Hire Engineer-Electrical (3) | Staffing and Hiring | Quarter 2 |
| Establish Board of Directors | Leadership | Quarter 3 |
| Hire Sales Specialist (2) | Sales Goals | Quarter 4 |
|  | Deliver large orders | Sales Goals | Quarter 4 |

**Chapter 6: Management and Human Resources**

RadAlert recognizes that the strength of the founding team will be directly tied to our firm’s success. We will operate in a technology sector that relies on highly educated employees; often with years of specialized experience. Because of this RadAlert expects to pay higher than average salaries and work to create an environment that makes it possible to attract and retain the highest levels of talent.

One of the ways we plan to do this is through creating a company culture that centers on empowering employees and rewarding innovation. We also plan to offer competitive pay, generous benefits, and an engaging and positive work environment. Technology companies generally have smaller and higher paid staff, but still generate high profit margins through the value of the intellectual property they create.

In the early stages of the firm, we may not be able to offer salaries as high as when revenue begins to grow. To compensate for this we plan to offer equity or stock to early employees. As the company grows we also intend to offer stock options to increase employee loyalty.

**Firm Staffing**

RadAlert will employ a number of different employee types that are needed to manage a technology based firm. The core of the firm will be the engineers needed to design, build and implement new products. We anticipate hiring many types of engineers but see electrical and nuclear engineers as two of the main types of engineers we will initially seek to hire. As the firm grows we also anticipate hiring other types of engineers including software engineers, industrial and manufacturing engineers.

**Employee Levels**

RadAlert will hire employees within three general tiers. This will include entry-level employees, mid-level employees, and senior-level employees. These categories are based primarily on years of applicable experience. Hiring-level guidelines are used to provide salary recommendations and as a reference for assigned responsibility levels.

|  |  |  |
| --- | --- | --- |
| **Level** | **Category** | **Relevant**  **Experience** |
| 1 | Entry | 0 to 3 years |
| 2 | Mid | 3 to 8 years |
| 3 | Senior | >8 years |

**Table 6.1:** Firm Hiring Levels

**Employee Types**

Rad Alert will initially employ personnel in one of five categories including Leadership, Engineering, Account Managers, Administrative, and Contract Labor. These positions will cover the major firm functions including accounting, management, human resources, marketing, customer service, accounting, information technology, and new product development.

**Type 1: Leadership**

Dr. Benke and Dr. Hamby will operate as two key leaders of the firm and plan to be hands on with all aspects of the growing company. Dr. Benke is the current firm President and Dr. Hamby is the current firm Vice President. We also intend to establish a CEO in the early stages of operations. As the firm grows more firm leadership positions will be established.

**Type 2: Engineering**

Engineers will make up the core of our research and product development endeavors. The initial product is being developed primarily by individuals holding nuclear engineering, electrical engineering, physics and health physics degrees. These types of engineers will most likely remain core to our product development. As the firm expands we also anticipate needing software, industrial and manufacturing engineers. We see software as a potentially promising area of growth and this would require establishing a core software team. As teams grow we anticipate establishing engineering leadership positions to help manage and run the day to day development activities.

**Type 3: Account Managers**

While engineering employees will be crucial to new product development our account managers will be the driving force behind product sales. Essentially, they will be a sales force but we are calling them account managers because we see them fostering long term relationships with customers. This is important when local government agencies and police forces may make incremental purchases over a number of years. We hope to create a product that becomes an industry standard; if we are able to do this our focus will become more on product awareness and marketing.

We do not anticipate a particular degree for this field but will most likely require at least a bachelor’s degree since we will need these employees to understand the technical nature of our products. We also will look for individuals we feel can build relationships, since we do not feel a high pressure sales approach would help our company achieve and sustain long term growth. Our goal will always be to meet customer needs with superior products. Account Managers will also interact with other partners such as ballistic vest manufacturers and vendors.

**Type 4: Administrative**

Administrative staff is somewhat of a broad category that will encompass those individuals who handle all other business related aspects of the firm. As the firm grows this may split into more traditional business categories such as accounting, human resources, marketing and information technology.

The first employees brought into this role will be responsible for handling incoming calls, scheduling meetings, responding to emails and all other aspects of the day-to-day running of a business. It is possible that the first person brought into this role may be given a high degree of responsibility and they will be compensated to match the level of demands that will be placed upon the position.

**Type 5: Contract Labor**

Contract labor is currently being employed to develop our product. This is an effective way to get work done and we currently are working with highly skilled individuals including the electrical engineering team helping to develop our product. In the future we also see utilizing these types of employees when appropriate, especially for tasks that may not require a full time employee like graphic work, product design, website development or the design of new products. Eventually we anticipate more of these types of task will be brought in house.

**Employee Benefits:**

All employees will be offered a comprehensive medical, dental and vision plan. The additional cost of these benefits is estimated into the overall budget through each employee’s compensation package. The firm will also explore offering other benefits such as tuition reimbursement, fitness memberships, and other perquisites as the budget allows.

**Employee Stock and Equity:**

RadAlert plans to offer stock options to firm employees. We are considering offering equity to key new employees that are brought in to fill leadership roles. If employees are offered equity we would offer equity that would vest over time. In the early start of the firm we plan to do this to help compensate for lower salaries until revenue allows us to offer competitive pay and benefits packages. Even when the firm is profitable we will look at offering stock to all employees as a way to increase individual employee commitment to the firm.

**Chapter 7: Operations Plan**

RadAlert operations will be similar to other firms that engage in research and development and sales to other businesses and government entities. Our operations particularly will be similar to other firms operating in the detector industry and hardware and software firms. We will have a core engineering team that will maintain and develop products and a business team that will handle the business operations. Currently, product development is being conducted by both founders and a team of engineers operating through contract labor. The business development operations are all being handled by the two firm founders.

We anticipate substantial changes in our operations over the next five years. These changes include hiring employees, establishing a firm office and introducing our first product to the domestic market. It is also possible that we might have operations taking place internationally either through manufacturing or product sales. We have already experienced changes in the course of taking our product from an idea to a small firm. These changes have included hiring engineers to develop the prototype, working with lawyers to secure a patent and establishing relationships with future customers.

Even though how we operate will be changing, we anticipate certain components of our operations to remain relatively stable. These include having a strong research and product development team, strong business operations and account executives driving sales. How we accomplish these tasks and the scale at which we operate will be what changes. We anticipate that a growing company will prevent new challenges, but we are confident we will be able to meet them. Our operations plan lays out some of the details of how our operations will be conducted.

**RadAlert Operations**

As stated earlier our operations will have two major components including the research and development of new products and the running of the day to day business operations. While there will be some layers of separation between these tasks we anticipate the firm running as a cohesive whole where all employees are encouraged to pursue our vision.

Our overall operations will be driven by the research and development of new technology. We have already established organizational know how related to hardware, software and radiation detection. This has allowed for the development of our product which combines these technology components in the form of a wearable technology device.

The other major area will include the business components; some of the areas we anticipate needing include sales, marketing, accounting and leadership. While the functions of each of these areas will be different we plan to have them highly integrated as a cohesive whole. One example of how this will work is that account executives will work closely with engineers to make sure product changes fit customer needs. Our leadership will be hands on making sure the company is working together to support the overall company vision.

**Research and Development**

Research and Development is the core of what RadAlert does as a firm. Our current research environment is being developed with the expertise of our founders and the engineers developing the product. The two founders bring their over 55 years of knowledge and experience of this field to the development of RadAlert’s research and development capabilities.

Product development relies on software, hardware and radiation detection equipment. We anticipate our research area being similar to the research labs found in Universities. Generally, this consists of a lab setting with access to needed radiation detection equipment. We will provide computer workstations with the specialized software needed by the different development teams. Our budgets take into account the costs needed to purchase or license the specialized software and equipment the engineers will need.

RadAlert intends to provide the needed space once an office is located. As the firm grows the number of labs used will grow correspondingly and more specialized labs will be incorporated. Our current operations will allow us to fully develop our first product with minimal financial outlays.

**Business Operations**

Currently our founders are handling all of the business operations of RadAlert. As the firm grows we intend to bring in two initial types of business employees. The first will be account executives who will work with clients to drive sales. The second will be an administrative assistant who will handle a lot of the office operations and also potentially other areas of the business. As the firm continues to grow we will begin to bring in more specialized employees to fill specific business needs. This will include employees for marketing, human resources, accounting and management.

**Office Space**

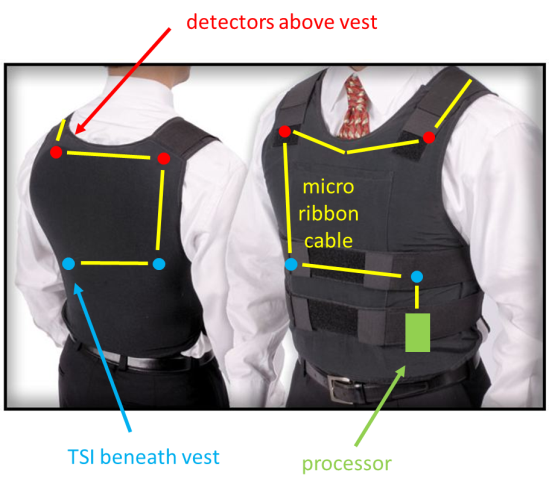
Currently RadAlert does not have an office space during the prototype development stage. Once the prototype is finalized we plan to rent a small single room office that the founders, contract workers and any other employees will have to operate out of. At this stage we will still be focusing on efficiency and keeping costs as low as possible. Receipt of a government-sponsored development grant or investor funding, will allow the firm to operate out of an office with research and development space where engineers can design, build and test current and future products.

Once the firm is generating sales and has full time staff we anticipate needing an office space that will allow for research and development and business operations. This will include a work station for all employees, meeting space and a break room. Another important area of the office will be the research area where employees will be able to build and design new products. It is possible that the engineering team may work from the research area of the office. RadAlert will do everything possible to provide a positive work environment and intends to model our workspace after technology firms who create a desirable environment that attracts top talent.

**Product Manufacturing Details**

The final product will be a wearable device that integrates seamlessly with the current vests that law enforcement officers use. As depicted in the image below, the product will have a number of interconnected components. Each component will have different manufacturing and design processes.

The product will have four miniature detectors positioned on the upper torso of the ballistic vest. Four micro tactile signal intensifiers (TSI) are placed in similar locations, but underneath the ballistic vest, in contact with the torso. Finally, the processing unit will slide into a pouch sewn on the carrier (Figure 7.1).

****

**Figure 7.1:** Product Manufacturing Design

**Detectors (4)**

Each unit will have four distinct detectors, in Figure 7.1 this is shown as the red dots and is the actual detector that will be used to detect the radiation. The detector is comprised of a PCB board and a scintillation crystal. The board itself is created through two steps, the first is the PCP fabrication process and the next is the PCP assembly where the circuitry is added. RadAlert will use external manufacturing firms for this process as there are many electrical service bureaus that can do this domestically or internationally.

Currently, RadAlert is utilizing a firm in Portland, Oregon that has the capabilities to do the fabrication and assembly of the electronics board. As the boards are finished they will be sent back to our assembly area. The next step is finalizing each detector with the scintillation crystal. This final manufacturing step for the detectors would be done at RadAlert’s offices. At higher level sales we may look at outsourcing all aspects of detector assembly so that a finalized detector unit is delivered.

**Control Unit**

The next major component is the processor, which is shown as a green dot in Figure 7.1. The board for this unit will go through the same PCB fabrication and assembly. At lower sales levels RadAlert plans to manufacture the plastic case by outsourcing it to a 3D printing firm and at higher levels potentially contract with a large scale producer. These components will also be sent back to our offices to be assembled.

**Detector Harness and Directional Guidance System**

The next major component is the actual harness that holds the detectors and guidance system into the vest. We will most likely outsource the manufacture of the actual harnesses. Once all the pieces arrive we will assemble them at our offices. At higher sales volumes we will look at outsourcing all product manufacturing.

**Operating Expenses**

RadAlert has prepared financials estimating the cost of operations over the next five years of growth. We anticipate labor being the highest fixed cost with rent, research and development, legal and business travel also being major expenditures. Figure 7.2 is an estimation of where revenue will be used but we anticipate this changing greatly depending on revenue and duration of operations. One example of how we see this shifting is that as revenue grows we would expect that less money would be used towards legal costs.

**Figure 7.2:** Average Expenditures as a Function of Total Budget

**Labor and Staffing**

RadAlert anticipates our highest expenditure going towards labor. As discussed in Chapter 6, we anticipate hiring a team of individuals to develop our products and operate our business. We recognize the importance of the team we build and because of this plan to compensate them with above average salaries comparable to other firms working in similar industries with similar job functions. We will be operating in a very specialized field where a small number of scientists and engineers are able to generate intellectual property that can be translated to a valuable revenue stream. Even with these higher levels of salaries we will still be able to operate with high net profit margins.

In establishing our operations we created a baseline for salaries (Appendix 7.1) that allows us to gauge compensation levels for employees. In all future financials showing an employee’s salary this number includes their base salary plus benefits. In our operation plans where we compensate employees below industry standards we intend to offer these employees stock, or in the case of leadership roles we may offer equity.

RadAlert currently uses highly skilled engineers who work on a contract basis. We intend to continue utilizing contract labor until revenue allows for office space and the ability to bring in our first full time employee. It should be noted that even though we discuss using contract labor these are engineers that the founders know well and are highly specialized and trained in the areas they are being brought in to work on. For instance, one current contract worker is a fellow Professor in the Nuclear Science and Technology Department at Oregon State University.

Additional employee costs (Table 7.1) will cover all expenditures related to providing employees the equipment and space they need to be successful. There are two main types of employee costs including a one-time costs and recurring costs. One-time costs are related to providing office space and a computer workstation. Recurring costs include a business phone and a budget to cover any other software or supply costs the employees may need. It should be noted that we do not include any employee benefits in these estimates.

**Table 7.1:** Estimated Cost Per Employee

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Individual Employee Costs** | | | | |
| **One Time** | |  | **Recurring (yearly Cost per employee)** | |
| **Item** | **Cost** |  | Office Supplies | $400 |
| Desk | $500 |  | Phone | $600 |
| Office Chair | $200 |  |  |  |
| Computer & Printer | $2,000 |  |  |  |
| MS Office Suite | $250 |  |  |  |
| Software License | $100 |  |  |  |
| **Total** | **$3,050** |  | **Total** | **$1000** |

**Office Space and Utilities**

Rent and utilities may include office rent, electricity, water, sewer, internet, natural gas and communications. At lower levels of funding, RadAlert will operate out of a single office rental space. We estimate rental costs for a staff up to 20 people (Table 7.2). A budget of approximately $600 per month will be used to cover utility expenses as the lowest base point and this number will go up as the company grows. The rent costs for RadAlert will change as the firm grows. In the first year, and at lower levels of sales or funding, the company will operate without a formal office. However, our goal is to establish our first office space in year two of firm operations.

**Table 7.2:** Monthly Rental Costs as a Function of Office Size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Company Size** | **Square Feet** | **Range Low** | **Range High** | **Average** |
| 0 to 3 | 750 | $1,125 | $3,750 | $2,438 |
| 3 to 10 | 1500 | $2,250 | $7,500 | $4,875 |
| 10 to 15 | 2250 | $3,375 | $11,250 | $7,313 |
| 15 to 20 | 3000 | $4,500 | $15,000 | $9,750 |

We intend to allow for $200 per month for utilities while we operate without a large office during our first year of funding. During our second year we plan to allocate $600 to cover utilities. As the firm grows this number will rise accordingly.

**Office Supplies**

A budget will be allocated towards office supplies and will be related to total employees and revenue. The items will include all the necessary components that an office uses in day to day business. A few examples of what this budget will cover includes paper, pens, pencils, printers, break-room food and office decorations.

**R and D**

Research and development costs will include costs directly related to the development of new technology. This will include costs on expenditures related to applicable software products, hardware, detection equipment and any other materials and supplies that might be required during product development.

**Legal**

RadAlert plans to continue to protect our intellectual property with patents, trademarks, and copyrights. We currently are working with a patent attorney and plan to utilize law firms to protect innovations and intellectual property. As the firm grows, we expect to incur other legal expenses related to human resources, operations, IP, or potentially taking the firm public.

**Travel Budget**

The travel budget covers all company related travel expenditures. One major component of the travel budget will be paying for domestic travel to meet with potential clients. Since we foresee the potential for large contracts, it will be imperative to speak with potential clients and give them a hands-on demonstration of how easily the technology works.

**Table 7.3:** Average Trip Expenses for Three Day Trip

|  |  |
| --- | --- |
| **Business Trip Cost** | |
| **Item** | **Cost** |
| Food Per Diem | $250 |
| Hotel | $450 |
| Rental Car | $300 |
| Airfare | $1,000 |
| Miscellaneous | $100 |
| **Total Cost** | **$2,100** |

RadAlert sees most trips including two travelers. Just one member of the team might attend some events, whereas other trips may require more employees. For this reason in putting together financials, RadAlert will use a budget of $2,100 per trip.

**Chapter 8: Marketing and Sales Strategy**

RadAlert will employ a number of strategies in order to effectively market and sell our initial product and future product lines. Our first product targets front‑line law enforcement personnel, operating within the United States, with a sales and marketing strategy tailored to this audience. Future growth areas include expanding to government agencies, to the military, and possibly internationally.

Keep in mind that the firm will consider separate ventures into the much larger consumer market with adjustment to our patented wearable directional guidance technology for syncing with smart phones, navigation, or gaming systems. However, our initial marketing and sales strategy is built for the first target audience.

**Product Demonstration**

We plan to employ a range of sales tactics but plant to utilize a hands on product demonstration to prospective customers. It is important to be able to see and feel the actual equipment. Currently, our competitors loan detector equipment to prospective customers to remove uncertainties prior to purchasing decisions, we will achieve this initial sales volume with in-person visits at the customer sites that involve side-by-side comparisons and field demonstrations so that the transformational impact of our intuitive feedback system can be realized firsthand by end users and purchasing representatives. Customer participation in side-by-side comparisons involving RadAlert, current onsite equipment, and other competitor’s models will provide convincing evidence that RadAlert’s benefits outweigh the initial apprehension and skepticism with new products.

Due to its revolutionary and intuitive user operation, holding and wearing the product leave lasting and convincing impressions to accompany otherwise brief presentations to law enforcement officers and decision makers. To accelerate the firm’s ability to engage customers as well as funding sponsors, a demonstration vest was fabricated with lower cost infrared sensors, instead of the scintillation detectors for ionizing radiation (*e.g*, x and gamma rays).

For the hands-on demonstration, one participating officer dons the vest, and the remaining group forms a circle around the officer. Each member of the circular formation has an infrared source directed in the general vicinity of the officer. The infrared source is similar in size and shape to a laser pointer, but its emissions are invisible. Only one of the infrared sources has active batteries, to ensure one radioactive source is simulated. Both infrared and ionizing radiation are invisible to the human eye. Without visible clues to differentiate the single energized source from the others, everyone is blind to the location of the source—everyone *except* for the RadAlert wearer. When the source is energized, the officer wearing RadAlert feels the system respond. RadAlert responds in real time. As the officer turns, the feedback changes. When the officer moves toward the energized source, the feedback changes again, giving further confirmation that the invisible assailant has been found. In essence, RadAlert gives the officer a sixth sense. Beyond demonstrating how effective the guidance system is, the wearer also appreciates how unobtrusive the product is—its small form factor increases the weight of the ballistic vest by less than 15 percent.

**Reaching the Initial Target Market**

Law enforcement agencies of large and medium sized cities, such as New York City, Houston, Los Angeles, Chicago, Washington DC, San Francisco, Portland, or Seattle, and other significant ports of entry comprise RadAlert’s initial target market. For this government-funded market, outreach activities are concentrated at three levels:

* Federal government
* State government agencies
* Local law enforcement authorities

Accessing local end users requires outreach at state and federal levels because federal and state decision makers still influence large- and medium-sized procurements destined for use by local law enforcement. The President of Alert R&D is a member of a working group providing guidance to the State of Texas on preventive detection of radiological and nuclear materials. Federal government contractors assemble these meetings and are responsible for coordinating and supporting similar efforts in other states. These groups welcome presentations on new products and concepts. Presentation to the home working group is a given when a functional prototype is available for demonstrating ionizing radiation detection, but moreover, a positive reception of the technology will compel organizers to schedule similar demonstration experiences in other states. Positive outreach visits will also include the U.S. Department of Homeland Security hubs. During an invited visit to the Domestic Nuclear Detection Office in Washington, DC, our President presented new technology aligned with the agency’s mission. As a result, this technological area was included in a list of federal funding priorities. In 2017, he was invited to the National Urban Security Technology Laboratory in New York City.

Lawrence Livermore National Laboratory and Pacific Northwest National Laboratory provide technical support to the Domestic Nuclear Detection Office. Visiting these laboratories is valuable because staff assemble market information and test new technologies for the federal government. Given the less-than-certain future for NUSTL in the New York City location, essential functions could shift to these national laboratories.

If our marketing research reveals that medium-sized cities are preparing to purchase radiation detection equipment, we will include them in our promotional tour. Even an order of 50 units would raise nearly $100,000 in revenue. If not, our attention will remain at claiming an appreciable market share from existing detector companies selling to law enforcement organizations.

**Marketing Strategy & Anticipated Risks**

RadAlert’s marketing strategy depends on relationships. The company’s executives have already met with the chief scientist of the New York City Police Department under a nondisclosure agreement. Dr. Hamby’s contacts at the Corvallis Police Department and the Benton County Sheriff’s Office have already been supportive and helpful.

A relationship approach is favored over a sales approach. This means expanding our contacts and slowly expanding our network. Respected within the nuclear and radiation safety fields, Drs. Benke and Hamby find themselves in a close-knit community of professionals, familiar from academic research, private industry, conferences and state and government agencies. Some of these colleagues are former students of RadAlert’s co-founders. These close colleagues are not expected to purchase large numbers of detectors but could become early adopters who contribute testimonials and additional feedback.

Customer service is a known weakness of our competitors. Initially contracts will be obtained and maintained by our founders, and later by account managers. Because our competitors are not as strong at customer support, we plan to assign the account manager as the primary point of contact with respect to sales, maintenance, troubleshooting, and customer feedback. Testimonials on positive customer support experiences from early adopters may prove to be a catalyst for larger contracts. As previously stated, maintaining contact with federal government staff is important for securing small business innovation research grants and staying apprised of new trends and areas of need.

**Marketing Timeline**

The marketing timeline for RadAlert is shown in Table 8.1. Much of this strategy will be adjusted during the next five years in order to optimize the process.

**Table 8.1:** Marketing Timeline

|  |  |
| --- | --- |
| **Year** | **Task** |
| **Year 1** | Begin to Establish Industry Contacts |
|  |  |
| **Year 2** | Continue to Foster Industry Relationships |
|  | Launch Website |
|  | On-site demonstrations in Texas, Oregon, & New York |
|  | On-site demonstrations in Washington DC |
|  | On-site demonstrations in California and Illinois |
|  | On-site demonstrations in Washington and Florida |
|  |  |
| **Year 3** | Increase Online Presence |
|  | Target Smaller Contracts |
|  | Utilize Account Executives to Create and Pursue Leads |
|  |  |
| **Year 4** | Expand Marketing Efforts to all US Cities |
|  |  |
| **Year 5** | Expand Marketing Efforts Overseas |
|  | Partner with Local Community Events |

**Pricing**

RadAlert is developing a high-end product that needs to be of the utmost quality and durability, capable of extended use in rough situations. For these reasons, superior product manufacturing is paramount and will be reflected in the price point. Originally, RadAlert will offer the system at $1,976 but will likely propose contract pricing. Others use this contract pricing strategy in the industry. As manufacturing increases, we will explore ways to lower production costs, but must be careful to not sacrifice quality. Future additions to the original detection and guidance systems will create a new pricing lines.

**Sales Team**

As has been discussed before RadAlert sees our sales team as instrumental to company success. We most likely will create these positions as account executives because while they will be actively engaged in sales it will be much more similar to building and maintaining customer relationships. There may be some initial contacts that could be seen as cold calling but it is not something that this position would be doing all day. An initial contact will be well researched and thought out before we call or email a potential new client. We will also attempt to leverage our existing networks to find ways to avoid choosing potential clients at random and contacting them.

The ideal sales process would be an introduction to a potential client who we are able to contact in person or through a video or phone call. We would hope to get know them and set up an in person product demonstration if they desire one. Finally, they would be able to approve or direct us towards those would could approve future purchases as the department or organization needs. Since the radiation detection field and law enforcement are both fairly close knit we feel we will be able to continue making these connections and later bring in account executives who will build on our existing relationships.

**Website and Social Media**

RadAlert will launch a company website once intellectual property has been secured. The website will have relevant company information, sales and contact information, clear explanation of the product and overall product information. We feel this is critical as it will allow interested customers to find information about our product, purchasing and contact information.

To protect its intellectual property, the company does not anticipate having an initial strong social media focus in the early stages. Due to the nature of the target market, these types of accounts are less important. If we do expand into social media, the firm would open Twitter, Instagram and Facebook accounts. The accounts would be used for marketing purposes, but would also take into account the user groups generally using these social platforms. For instance, Instagram relies on visual ascetics including bright, interesting or fun photos. Twitter on the other hand is more content driven; often offering a more unique and interesting take on things. The important point is that content is compelling, encouraging users to engage, like and follow. A flat or uninspired social media campaign may end up discouraging customers rather than encouraging them.

**Chapter 9: Financial and Economic Details**

We have conducted an analysis of the financial and economic factors that will influence our first five years as a firm. Our financial analysis was conducted with a very moderate sales forecast. The reason we did this is to lay a foundation of how the company would run given moderate sales for the first five years. This forecast does not include sales that could arise from the expansion of our product line or international expansion. These financials do not include any government grants which is a potential source of expansion developing technology for government agencies. Finally, there is a strong probability that domestic sales could be much higher so we included a section analyzing higher sales volumes at the end and the associated rise in net income.

The financial data is compiled with estimated sales of 2,060 units over 5 years, creating revenue of $4 million. These projections include an investment of $150,000 to fund the first two years of operations until revenue wholly covers firm expenses. With $4 million in revenue we estimate that our cost of goods sold will be $1.8 million and our operating expenses will be $1.5 million. This will leave a five year net income of $835,000 before taxes.

Conservatively, our sales estimates are equivalent to capturing about 1 percent of the domestic law enforcement market, which may represent a decent start but is just beginning to scratch the surface of claiming market share from existing detectors whose increasing replacement by RadAlert units is fathomable within this target market near the end of the first five years. These growth years, however, fall beyond the current outlook of the first five years. We include assessments for the resulting investor returns at higher sales levels. Our sales data do not take into account entrance into new markets or international sales.

Data is used from our market analysis, i.e., from sales estimates for domestic law enforcement agencies and a realistic view of foundational activities during the first five years of operation. For example, competition for federal funding is fierce. Based largely on innovation and outreach, success will be achieved from exposure to our mockup and prototype demonstration. Conveniently assuming that funding will be awarded during the first proposal attempt is simply overconfident at best and foolhardy at worst. Historically, the U.S. Department of Homeland Security has funded low to moderately risky projects. Our perseverance will be tested; this is true in government funding as well as the commercial market. The milestone schedule does not assume a success rate of 100 percent.

**Unit Price and Details**

We intend to offer our first detector starting at $1,976 per unit. With a unit production cost of $875 this will leave a unit contribution of $1,101 per unit (Table 9.1). The details of the unit price, cost and contribution margin are detailed below.

**Table 9.1:** Rad Alert Unit Sales Price and Contribution Margin

|  |  |
| --- | --- |
| **Unit Price** | $1,976 |
| **Cost Per Unit** | $875 |
| **Unit Contribution** | $1,101 |
| **Unit Contribution Margin** | 56% |

**Unit Price**

The unit price of $1,976 was derived by looking at current market prices, current contract prices and industry standards. The first tool we utilized was analyzing the industry standards of similar firms including Thermo Fisher Scientific. These firms were found to operate with a contribution margin ranging between 45% to 60%. Our contribution margin is 55% which fits well with other firms in the hardware industries.

Next we analyzed the large scale purchase of the LAPD. This purchase consisted of 1,800 basic units in 2014 with an average cost of $1,610[[15]](#footnote-15).The final metric we used in estimating our price was the U.S. Department of Homeland Security report that analyzed eleven PRDs with an average cost of $3,478[[16]](#footnote-16). We hope to eventually get our price down even further to around $1,500 per unit which we feel would give us a significant competitive advantage and increase overall firm income through much higher demand and sales.

**Unit Costs**

The process of developing each unit is discussed in Chapter 7. The development costs consist of the direct labor and parts for the unit. Each unit consists of four detectors, four guidance system sensors and a control box. Our current estimate is $875 for all labors and parts for each unit. This estimate is a high end estimate and even with our current manufacturing chain we think that as we manufacture to fill our first orders we may be able to manufacture for much lower than $875. The main reason for this is the high labor costs we put in which will most likely come down significantly.

As we grow we will look into larger scale manufacturing options that would be cheaper and more efficient. However, these options make sense cost and time wise when we have begun to sell higher volumes. The trip costs alone to set up an overseas manufacturing chain would be cost prohibitive in our first three years of operations. We also are confident that our current manufacturing chain could handle fairly large orders and is the most efficient choice for our current firm status.

**Table 9.2:** Unit cost table

|  |  |  |  |
| --- | --- | --- | --- |
| **Product Costs:** | **Unit Cost (5 Units)** | **Unit Cost (5 Units)** | **Unit Cost (500 Units)** |
| **PCB fabrication** | $5 | $2 | $1 |
| **PCB assembly** | $100 | $90 | $80 |
| **BGO Crystals (4)** | $200 | $160 | $120 |
| **Detector PCB Fabrication (4)** | $20 | $15 | $10 |
| **Detector PCB assembly (4)** | $100 | $80 | $60 |
| **3D Plastic Components** | $5 | $4 | $3 |
| **Connectors and other parts** | $10 | $8 | $6 |
| **Assembly** | $10 | $10 | $10 |
| **Battery** | $3 | $2 | $1 |
| **Charger** | $6 | $5 | $4 |
| **Motors (4)** | $12 | $8 | $4 |
| **Labor** | $450 | $491 | $400 |
| **PRODUCT COST** | **$921** | **$875** | **$699** |

**Sales Projections:**

RadAlert’s sales projections show an estimated 2,060 units sold over 5 years, resulting in a total revenue of around $4,070,560. These sales projections are very modest and take into account using about two years to finalize a market ready product.

Our sales projections are based on a number of factors including creating and fostering relationships with decision makers who can approve purchases, current market trends and potential future trends. One key component of our projections was the Los Angeles purchase of 1,800 units for almost $3 million dollars. We know that this is a particularly large purchase for a highly populated metropolitan area but it is a good indicator of potential sales, and one of the reasons we hope that our sales over five years end up much higher than our current forecasts.

**Figure 9.1:** RadAlert Five Year Sales Projections

**Figure 9.2:** RadAlert Units Sold

Sales projections are based on estimates where RadAlert utilizes our investment funding to finalize our product development and utilizes sales revenue to hire account executives. Table 9.3 shows an overview of our sales projections and financial projections for the first five years of operations. We anticipate the firm being profitable in year three of operations.

**Table 9.3:** RadAlert Five Year Operations Data

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |  | **Total** |
| **Units Sold** | 0 | 60 | 200 | 600 | 1,200 |  | 2,060 |
| **Revenue** | $0 | $118,560 | $395,200 | $1,185,600 | $2,371,200 |  | $4,070,560 |
| **Investment** | $69,400 | $80,600 | $0 | $0 | $0 |  | $150,000 |
| **COGS** | $0 | $52,500 | $175,000 | $525,000 | $1,050,000 |  | $1,802,500 |
| **Operating Expenses** | $69,400 | $80,600 | $132,400 | $426,600 | $808,000 |  | $1,517,000 |
| **Income** | **$0** | **$0** | **$87,800** | **$234,000** | **$513,200** |  | **$835,000** |

**Operating Expenses**

RadAlert’s operating expenses cover all fixed costs not directly tied to unit sales (Table 9.4). As the company grows, these costs will rise proportionally to total sales, but will still be considered fixed costs. Firm leadership may be brought in at lower salaries but compensated with equity or stock options. RadAlert expects to experience increasing growth every year of operations and will plan to operate a dynamic and growing firm. A summary of operating expenses if provided in Table 9.4 and Table 9.5.

**Table 9.4:** Total Five Year Expenditure by Cost Category

|  |  |
| --- | --- |
| **Category** | **Expenditure** |
| Labor, Materials and Supplies | $1,802,500 |
| Research and Development | $102,500 |
| Selling General and Administrative | $1,180,200 |
| Rent | $69,600 |
| Utilities | $28,800 |
| Office Supplies | $12,000 |
| Travel Expense | $71,400 |
| Insurance | $5,000 |
| Legal | $47,500 |

**Table 9.5:** Detailed Five Year Expenditure

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Item** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Labor | CEOe | $22,000 | $34,000 | $60,000 | $95,000 | $100,000 |
| Labor | CTOe | $0 | $0 | $0 | $45,000 | $90,000 |
| Labor | Electrical Engineer | $0 | $0 | $0 | $80,000 | $90,000 |
| Labor | Electrical Engineer | $0 | $0 | $0 | $0 | $90,000 |
| Labor | Account Executive | $0 | $0 | $0 | $0 | $80,000 |
| Labor | Account Executive | $0 | $0 | $0 | $80,000 | $80,000 |
| Labor | Administrative Assistant | $0 | $0 | $0 | $0 | $60,000 |
| Labor | Interns | $0 | $0 | $0 | $0 | $16,000 |
|  | Contract Labor (1099) |  |  |  |  |  |
| Labor | Electrical Engineer | $12,000 | $12,000 | $18,000 | $4,000 | $20,000 |
| Labor | Nuclear Engineer | $6,000 | $6,000 | $8,000 | $8,000 | $6,000 |
| Labor | Design Engineer | $0 | $0 | $0 | $2,000 | $6,000 |
| Labor | Manufacturing Engineer | $0 | $0 | $0 | $2,000 | $8,000 |
| Labor | Graphic Designer | $0 | $0 | $0 | $2,000 | $4,000 |
| R and D | Engineering Supplies | $7,000 | $7,000 | $7,000 | $23,000 | $24,000 |
| R and D | Equipment | $2,500 | - | $5,000 | $8,000 | $20,000 |
| SGA | Software | $5,000 | $2,000 | $5,000 | $7,200 | $14,000 |
| Rent | Office Rent | $4,800 | $4,800 | $4,800 | $24,000 | $31,200 |
| Utilities | Utilities ($1000/month) | $2,400 | $2,400 | $2,400 | $9,600 | $12,000 |
| Insurance | Liability Insurance | $0 | $0 | $1,000 | $2,000 | $2,000 |
| Supplies | Office Supplies | $1,000 | $1,000 | $1,000 | $4,000 | $5,000 |
| Travel | Travel | $4,200 | $4,200 | $12,600 | $16,800 | $33,600 |
| Legal | Legal Fees | $2,500 | $7,200 | $7,600 | $14,000 | $16,200 |
|  | **TOTAL** | **$69,400** | **$80,600** | **$132,400** | **$426,600** | **$808,000** |

**Income Statement**

We have developed a five year income statement based on our sales projections and operating expenses that spans our first five years of operations (Table 9.6). The operating expenses in Year 1 and Year 2 will be covered by the financial investment. In Year 3 revenue from sales will allow for the firm to become self-sustaining.

**Table 9.6:** RadAlert Five Year Income Statement

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| **Revenue** |  |  |  |  |  |
| Total Revenue | $0 | $118,560 | $395,200 | $1,185,600 | $2,371,200 |
|  |  |  |  |  |  |
| **Cost of Revenue (Goods Sold)** |  |  |  |  |  |
| Labor, Materials and Supplies | $0 | $52,500 | $175,000 | $525,000 | $1,050,000 |
| Total Cost of Revenue | $0 | $52,500 | $175,000 | $525,000 | $1,050,000 |
|  |  |  |  |  |  |
| **Gross Profit** | $0 | $66,060 | $220,200 | $660,600 | $1,321,200 |
|  |  |  |  |  |  |
| **Operating Expenses** |  |  |  |  |  |
| Research and Development | $9,500 | $7,000 | $12,000 | $31,000 | $43,000 |
| Selling General and Administrative | $45,000 | $54,000 | $91,000 | $325,200 | $665,000 |
| Rent | $4,800 | $4,800 | $4,800 | $24,000 | $31,200 |
| Utilities | $2,400 | $2,400 | $2,400 | $9,600 | $12,000 |
| Office Supplies | $1,000 | $1,000 | $1,000 | $4,000 | $5,000 |
| Travel Expense | $4,200 | $4,200 | $12,600 | $16,800 | $33,600 |
| Insurance |  |  | $1,000 | $2,000 | $2,000 |
| Legal | $2,500 | $7,200 | $7,600 | $14,000 | $16,200 |
| Other |  |  |  |  |  |
| Total Operating Expenses | $69,400 | $80,600 | $132,400 | $426,600 | $808,000 |
|  |  |  |  |  |  |
| **Operating Income** | -$69,400 | -$14,540 | $87,800 | $234,000 | $513,200 |

**Variations on Sales Forecasts**

It is important to look at a range of potential sales forecasts that could be experienced by RadAlert in our first 5 years of operations. We will do everything we can to drive sales and it is feasible that large orders could quickly come in over the course of five years that reach levels shown below (Table 9.8).

**Table 9.8:** Sales Forecasts for Five Years at Eight Potential Sales Levels

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sales** | **Units Sold** | **Cost of Revenue** | **Operating Expenses** | **Income** | **Profit Margin** | **Investor Return at 10% Equity** |
| $98,800,000 | 50,000 | $43,750,000 | $31,616,000 | $23,434,000 | 24% | $2,343,400 |
| $88,920,000 | 45,000 | $39,375,000 | $28,454,400 | $21,090,600 | 24% | $2,109,060 |
| $79,040,000 | 40,000 | $35,000,000 | $25,292,800 | $18,747,200 | 24% | $1,874,720 |
| $69,160,000 | 35,000 | $30,625,000 | $22,131,200 | $16,403,800 | 24% | $1,640,380 |
| $59,280,000 | 30,000 | $26,250,000 | $18,969,600 | $14,060,400 | 24% | $1,406,040 |
| $49,400,000 | 25,000 | $21,875,000 | $15,808,000 | $11,717,000 | 24% | $1,171,700 |
| $39,520,000 | 20,000 | $17,500,000 | $12,646,400 | $9,373,600 | 24% | $937,360 |
| $29,640,000 | 15,000 | $13,125,000 | $9,484,800 | $7,030,200 | 24% | $703,020 |
| $19,760,000 | 10,000 | $8,750,000 | $6,323,200 | $4,686,800 | 24% | $468,680 |
| $9,880,000 | 5,000 | $4,375,000 | $3,161,600 | $2,343,400 | 24% | $234,340 |

Sales could increase through a number of mechanisms as our product becomes commercially available. The first would be that Law Enforcement Agencies work to equip officers in the U.S. at a higher coverage percentage than our sales forecasts estimate. Our forecasts were intentionally calculated at a low and conservative level, but we will actively work to bring in revenue above these levels. The second is that we expand internationally, an achievement that is not accounted for in our current sales projections. International expansion is quite feasible early on and certainly would be worth the effort as the firm grows. A third potential reason for higher sales would be political events which could dramatically increase demand worldwide. A fourth reason could be expanding our product lines or developing new technology in the first five years of operations.

Due to these potentially higher levels of sales, we include sales projections for RadAlert ranging from 5,000 to almost 50,000 units (Table 9.8). The estimated operating expenses include a forecast of what it would cost to build and run a team at this level of revenue. This would include bringing in a well-paid staff of engineers who can continue to lead RadAlert’s new production innovation and development.

**Use of Venture Funds**

The funding that RadAlert is seeking will be used during the first two years of operation (Table 9.9). These funds will cover the costs of labor directly tied to finalizing the prototype and generating sales contracts with major cities. A portion of the funding also will be used to cover legal expenses required to secure intellectual property.

**Table 9.9:** User of Venture Investment

|  |  |  |
| --- | --- | --- |
|  | **Year 1** | **Year 2** |
| **Item** | **Budget** | **Budget** |
| CEOe | $8,000 | $12,000 |
| CTOe | $8,000 | $12,000 |
| CFO/CMOe | $6,000 | $10,000 |
| Contract Labor (1099) |  |  |
| Electrical Eng | $12,000 | $12,000 |
| Nuclear Eng | $6,000 | $6,000 |
| Engineering Supplies | $7,000 | $7,000 |
| Equipment | $2,500 | $0 |
| Software | $5,000 | $2,000 |
| Office Rent | $4,800 | $4,800 |
| Utilities ($200/mo) | $2,400 | $2,400 |
| Office Supplies | $1,000 | $1,000 |
| Travel^ | $4,200 | $4,200 |
| Legal Fees | $2,500 | $7,200 |
| **TOTAL** | **$69,400** | **$80,600** |

**Break Even Analysis**

A break even analysis was used to estimate the varying levels of sales that would be needed to cover RadAlert’s fixed costs. With a contribution margin of $1,101 per unit sold, RadAlert will need to sell 140 units in order to break even with $150,000 in fixed costs. At 140 units, total revenue will cover both fixed and variable costs and any sales over 140 units will contribute towards firm net income (Figure 9.3).

**Figure 9.3:** Break Even Analysis at 150,000 Fixed Costs

The total unit sales needed to break even was also analyzed for fixed costs ranging from $150,000 to $5,000,000 (Table 9.8). RadAlert will take care to make sure that fixed costs do not grow faster than sales, as this would lead to firm debt and cash flow issues.

**Table 9.7:** Break Even Analysis at Multiple Revenue Levels

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fixed Costs (FC)** | **Variable Costs (VC)** | **Total Costs** | **Break Even Unit Sales** | **Total Revenue** |
| $150,000 | $122,093 | $272,093 | 140 | $272,093 |
| $250,000 | $203,488 | $453,488 | 233 | $453,488 |
| $500,000 | $406,977 | $906,977 | 465 | $906,977 |
| $1,000,000 | $813,953 | $1,813,953 | 930 | $1,813,953 |
| $1,500,000 | $1,220,930 | $2,720,930 | 1395 | $2,720,930 |

**Financial Metrics**

Since RadAlert is currently in product development, a number of key financial metrics were used to guide financial projections (Table 9.8). These were taken from industry standards from public companies operating in radiation detection and also in the hardware and software industries. These benchmarks are used as a guidance to ensure the firm is operating at levels that match leaders in the industry and that we do not overestimate or underestimate important financial numbers.

**Revenue Per Employee**

Revenue generation per employee is a benchmark used to guide RadAlert’s projected hiring. Our target goals are derived from industry leaders and all operations are based on staying in the target range of $400,000 to $700,000 in revenue generated per employee. These estimates are simply a guide to ensure we do not underestimate labor expenses since labor is one of the highest contributors to overall fixed expenditures. All RadAlert operations use this figure in determining labor costs.

**Profit Margin**

Another important metric is RadAlert’s profit margin. For this metric, we used the firm’s earnings before interest, tax, depreciation and amortization (EBIDTA). Utilizing industry standards we found that our profit margin around 20% was reasonable for the industry we will be operating in.

**Chapter 10: Legal, Intellectual Property and Ethical Issues**

RadAlert operates in a highly technical field requiring years of education and training in order to develop a product that meets current industry standards. The industry and competitor analysis revealed that there are high barriers to entry in this industry and that extensive knowledge is needed to develop a competing product. Even though this is the case, RadAlert is actively pursuing lowering competition through multiple avenues including patents, customer loyalty through good will, and constant innovation. We are securing our initial product with a patent that will protect the unique hands-free system that gives front line law enforcement officers the ability to passively locate and detect potential radiological terrorist threats.

**Business Entity and Status**

RadAlert is currently operated under the umbrella of Alert R&D, LLC, a Texas-based limited liability company. The two founders each hold 50% of the parent company. In the future, the firm may form a Board of Directors whose first members would be the two founders and investment partner.

**Intellectual Property and Patents**

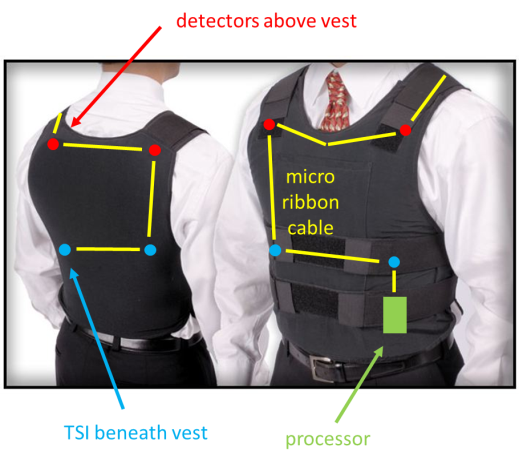
RadAlert has secured one patent which is discussed below. As RadAlert moves forward, we will actively pursue new intellectual ideas and work to secure them through patents, trademarks and copyrights. As we expand our research and development capabilities we plan to allow employees the freedom to develop and contribute their own ideas and develop a rewards system for their contributions.

Currently we work with a patent attorney in Portland, Oregon who helped write our patent. Our budget always allocates funds for legal fees related to advancing and securing our intellectual property.

**Patent:**

RadAlert’s patent is related to the ability of the user to locate a radioactive threat. This patent is based on four miniature detectors placed on the vest; two of these are placed on the chest and two are placed on the back of the vest. These detectors are placed high up on the vest giving the best down-range visibility for the detectors. These detectors are small but very sensitive to incident gamma-rays and x-rays. The processor slides into a small pouch inside the vest as can be seen in Figure 10.1. The overall patent was for threat detection and positioning to a system for passive nuclear, biological or chemical detection.

**Figure 10.1:** Location Sensing Technology



**Managing Legal Liability Risks**

RadAlert plans to be proactive in managing any legal risks that may arise. We are protecting intellectual property with patents, and managing risks through the purchase of product liability insurance and general business insurance to cover firm operation and our employees. As the firm grows we will continue to work to insure compliance with all appropriate state and federal legislations related to running a business.

**Chapter 11: Company Risks**

All new firms are faced with risks. As the firm evolves, new risks will emerge, which are discussed below. In our risk analysis we also provide some solutions

**Risks to Venture and Investors**

**Sales Risks**

One potential risk that RadAlert faces is finding and making the right contacts to make sales. Our product is unique and geared towards specific markets. This creates both positive and negative aspects in regards to generating sales. The fact that our product is specifically designed for a pressing need gives us a competitive advantage that we feel will allow us to grow rapidly. The difficulty will be marketing the product, making the right contacts and getting our sales team involved early enough to get approval for the budgets of the agencies we are selling to.

We intend to actively mitigate this risk through a number of strategies. The first is something both founders are actively engaged in and this is networking with local law enforcement agencies, industry members and government contacts. As account representatives are brought in they will be introduced into both founders networks and hopefully bring in their own industry connections. We are confident our product is superior as a way to actively prevent nuclear terrorist attacks and feel that by demonstrating the product and getting the right individuals involved we can lower sales risk.

**Cash on Hand**

A potential major problem that is a threat to any business is the availability of liquid assets to meet current accounts payable due each month. Some key areas where this could become an issue include meeting lease deadlines, paying staff, and having the operating capital to fund product manufacturing for future sales. RadAlert plans to handle this risk through limited overhead operation during the first two years, careful budgets, securing development grants from the federal government, and not expanding beyond their means.

The four major ways we anticipate bringing money into the firm include product sales, outside investment, government grants and loans. We intend to continue to have working capital for the first two years through either an outside investment or securing government grant. Through continued investment by both founders, a current mockup of RadAlert is available for initial demonstrations to government sponsors that could bring in a grant before the product has been completely finalized. If a grant is awarded on the first attempt, RadAlert’s development timeline would be accelerated and this plan would be revised accordingly. Government development grants allow technology companies to finalize products and generate revenue from relatively small working capital.

**Marketing Methods**

We do not anticipate our original product being purchased by the everyday consumer. Company success will depend on the convincing local, state, and federal decision makers that RadAlert provides a superior value to law enforcement agencies over existing PRDs. The nature of this makes marketing our product more difficult. Early on our marketing efforts will be targeted networking; an example would be attending trade shows and Homeland Security events. To mitigate this risk both founders are actively engaged in establishing and developing key government, industry, and customer relationships.

**Legal Risks from Product Failure**

Since RadAlert’s product is used to prevent catastrophic attacks, there is the chance that an active threat might be missed due to product malfunction. This threat is considered to be very low, but RadAlert plans to handle this through the purchase of general liability insurance and product efficacy insurance. Field testing under government funding will quantify the instrument performance in realistic and challenging operational environments. Demonstration of RadAlert’s superior performance compared to the competition would alleviate most of these concerns.

As the firm expands and considers international markets, overseas regulations will be reviewed on a country-by-country basis. These situations are not expected within the first 5 years and are not elaborated further in this plan.

**Meeting Federal Requirements for an Alarming PRD**

RadAlert is developing a sophisticated PRD with a personal guidance system. The government requires any alarming PRD to meet the standards presented in the *American National Standard Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security*. This risk is being minimized by following these standards during the development process. As stated earlier, the two founders have a combined 55 years of radiological experience and both hold PhDs directly related to develop systems in accordance with these standards.

**Overall Risk Assessment**

Prior to demonstration of superior performance of RadAlert in laboratory or field settings, the overall risk is considered to be high. Relying on their collective experience, the two founders consider this overall risk to be medium (instead of high) but are making strides to prove the concept by self-funding the venture and clearly showing its merits. After successful demonstrations, the overall risk immediately plummets to medium. After receipt of a government development grant or external funding, the overall company risk becomes low.

**Chapter 12: Venture Offering**

RadAlert is seeking an investment of $150,000 in order to quickly expand and take advantage of the market’s need for our product. With our current sales forecasts this would allow for a return on investment of around $83,500 for the investor during the first five years of operations. It should be noted that this is a very conservative effort and we discuss this more below. The investment will be used to finalize the development of a market ready product. We anticipate this process taking two years as we have already made significant progress with our prototype.

**Investment Offer**

RadAlert is seeking an investment of $150,000 dollars for a 10% equity in the firm. This places a current valuation of $1.5 million on the firm. We are confident that the firm will grow to be worth much more then this as we expand our product lines and we expand globally.

**Use of Funds**

The investment will cover RadAlert’s operating expenses for roughly the first two years of firm operation. After that, RadAlert plans to support costs through sales revenue and potentially government development grants. Initial funding allocations will cover a number of critical activities for producing a consumer ready product as quickly as possible (Figure 12.1 and Table 12.1).

**Figure 12.1:** Use of Investment Funds by Category

The major use of funds will be directly tied to the labor and staff needed to develop the product. This includes paying a CEO to run the firm and also contract engineers who are part of the development team. The next major expenses will be related to research and development and any software or hardware that will be needed to finalize the demo and actual product. Part of the funds will be used for legal expenses to continue securing our intellectual property. Another part of the funds will be used for travel expenses to potential clients and finalize purchases. Finally, part of the investment will be used for a small office and expenses related to utilities.

**Table 12.1:** DetailedUse of Investment Funds

|  |  |  |
| --- | --- | --- |
|  | **Year 1** | **Year 2** |
| **Item** | **Budget** | **Budget** |
| CEOe | $8,000 | $12,000 |
| CTOe | $8,000 | $12,000 |
| CFO/CMOe | $6,000 | $10,000 |
| Contract Labor (1099) |  |  |
| Electrical Eng | $12,000 | $12,000 |
| Nuclear Eng | $6,000 | $6,000 |
| Engineering Supplies | $7,000 | $7,000 |
| Equipment | $2,500 | $0 |
| Software | $5,000 | $2,000 |
| Office Rent | $4,800 | $4,800 |
| Utilities ($200/mo) | $2,400 | $2,400 |
| Office Supplies | $1,000 | $1,000 |
| Travel^ | $4,200 | $4,200 |
| Legal Fees | $2,500 | $7,200 |
| **TOTAL** | **$69,400** | **$80,600** |

**Return on Investment**

RadAlert has a very conservative five-year sales estimate of $4.07 million dollars. After covering operating expenses and the cost of goods sold, this will leave about $835,000 million in operating income. This will allow for a five-year return of $83,500 for the initial investment.

RadAlert is focused on building a large profitable company with multiple products. In five years, it is quite possible that we generate a much higher level of sales than our estimate of $4.07 million. We anticipate the investor making far more back through greater product sales over the life of the company through increased purchases of our detector and our future product lines. There is also the possibility of taking the firm public or of a larger firm acquiring us.

**Exit Strategies**

RadAlert operates as a privately held firm. For the initial target market, the option to be acquired within the first 10 years has a greater probability than entering open stock trading. For more than 20 years, companies including direct competitors in this market have relied on conventional user interfaces—devices with displays plus audible, visual, and vibratory alarms. Equipping law enforcement officers with PRDs is more recent. RadAlert’s revolutionary feedback system will receive plenty of attention, even at the onset. However in this newer market segment, the predominant detector manufactures are rather risk adverse and will wait for RadAlert’s success to be proven and sustained before they consider new model features or product lines to compete with us directly. For these medium- to large-sized companies, their costs to innovate and develop new products, on their own while not infringing on our intellectual property rights, will be quite large compared to ours. Even for larger companies that manufacture a broad range of scientific instruments, radiation detection divisions must demonstrate profitability independently. In other words, strategic vision of these companies to disproportionately concede precious corporate overhead and internal research funds for the long‑term welfare of their small radiation detection division will not be well received despite loses of market share to RadAlert.

At this point, economics favor these established companies to acquire our small firm, but because they will not act quickly and will wait until RadAlert actually hurts their sales, our company will have become profitable, and we will be negotiating from a position of comfort rather than exhaustion or desperation. Depending on details of these offers and the willingness to negotiate them further, turning down initial buy-out offers will probably yield much larger offers one year later.

If meeting increasing demand during this “option year” requires us to spend significant amounts of capital to increase production, selling before the upscaling becomes more attractive to us. Contrary to progressive thought, some larger companies have bought smaller companies and smothered their new technology because it benefits the larger company more (financially) in the short‑term to continue claiming their market share instead of disrupt the market and compete with itself. This tactic is neither scientific nor patriotic but rather a disappointing feature of capitalism.

Other applications of our intellectual property in larger markets bodes well for Alert R&D after the firm becomes a self-sustaining entity. Accessing these new markets falls outside the 5-year time period considered in this plan and will not be discussed further.

**Appendix**

**Appendix 1: The Company**

**Appendix 2: The Product**

**Appendix 3: Market and Industry Analysis**

**Appendix 3.1:** Total Sworn Officers

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **State** | **Sworn Officers** | **State** | **Sworn Officers** | **State** | **Sworn Officers** |
| Alabama | 9,329 | Kentucky | 6,280 | North Dakota | 1,024 |
| Alaska | 821 | Louisiana | 12,556 | Ohio | 22,785 |
| Arizona | 14,629 | Maine | 2,000 | Oklahoma | 6,220 |
| Arkansas | 5,528 | Maryland | 11,016 | Oregon | 5,285 |
| California | 66,866 | Massachusetts | 15,461 | Pennsylvania | 20,572 |
| Colorado | 9,649 | Michigan | 15,748 | Rhode Island | 2,527 |
| Connecticut | 6,838 | Minnesota | 7,887 | South Carolina | 9,431 |
| Delaware | 1,087 | Mississippi | 5,662 | South Dakota | 1,299 |
| District of Columbia | 3,070 | Missouri | 11,773 | Tennessee | 13,411 |
| Florida | 41,714 | Montana | 1,460 | Texas | 45,582 |
| Georgia | 20,277 | Nebraska | 2,921 | Utah | 3,788 |
| Hawaii | 2,983 | Nevada | 5,323 | Vermont | 647 |
| Idaho | 2,701 | New Hampshire | 2,514 | Virginia | 16,008 |
| Illinois | 33,004 | New Jersey | 24,459 | Washington | 9,877 |
| Indiana | 11,138 | New Mexico | 3,825 | West Virginia | 2,201 |
| Iowa | 4,483 | New York | 64,578 | Wisconsin | 11,439 |
| Kansas | 6,054 | North Carolina | 18,671 | Wyoming | 1,267 |
| **Total 625,668** | | | | | |

**Appendix 3.2:** Distributor Firms in the Radiation Detection Industry

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Competitor** | | | | **Direct Competitor** | **Industry** | **Company Size** | **Threat Level** | **Threat Notes** | **Description** |
| Alpha Spectra | | | | No | Radiation Detectors | Medium | Low |  | They are a distributor of radiation detection products |
| Atlantic Nuclear Corp | | | | No | Nuclear, Homeland Security | Small | Low |  | Sells Instrumentation and Calibration Services |
| EcoTest | | | No | Retailer | Medium | Low |  | Offers a wide range of nuclear and radiation equipment |
| Fluke Biomedical | | No | Medical | Large | Low |  | Fluke is a medical company that has a range of radiation dosimeters and safety products. They do not appear to focus on Homeland Security |
| FujiFilm Holdings | | No | Healthcare and Others | Large | Low |  | FujiFilm offers a range of products and touches on radiopharmaceuticals and diagnostic equipment. |
| Gamma Data | | No | Nuclear Industry, Science | Large | Low |  | Gamma Data is a supplier of instruments and tools related to the nuclear field and optronics |
| James Fisher Nuclear | No | Nuclear Industry | Large | Low |  | A range of nuclear industry related products and services |
| Laurus Systems Inc | No | Detection Products | Medium | Low |  | Laurus offers products related to multiple fields including hazmat, nuclear energy, oil and gas, homeland security, hospitals, military and education |
| Nuclear Technology Services, Inc. | No | Consulting | Small | Low |  | Offer books, software and consulting related to nuclear industry |
| Owens Scientific Inc | Potentially | Radiation Detection, Nuclear | Medium | Low |  | Sells a range of radiation related products |
| Qaltek | No | Radiation, Consulting, Nuclear | Medium | Low |  | Qaltek distributes radiation products and also works in consulting and installation |
| Radiation Detection Co | No | Dosimetry | Medium | Low |  | Radetco offers dosimetry solutions to a range of industries |
| Shimadzu | No | Healthcare, Medical | Large | Low |  | Medical Related Distributor |
| Southern Scientific LTD | Potentially | Radiation Detection, Nuclear | Large | Low |  | Offers a range of products some related to homeland security but it appears they are mostly a distributor |

**Appendix 3.2:** Firms Operating in the Nuclear Industry

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Competitor** | **Direct Competitor** | **Industry** | **Company Size** | **Threat Level** | **Threat Notes** | **Description** |
| AccuSync | No | Medical | Small | Low |  | Manufactures nuclear medicine and measurement Devices |
| AGFA Healthcare | No | Medical | Large | Low |  | They have Digital Radiography, Enterprise Imaging and Hospital IT |
| Arktis | Potentially | Tactical Apparel | Large | Medium |  | Manufacturer of gear for special forces and law enforcement |
| Arrow Tech | Yes | Homeland Security, Healthcare, Academia | Medium | Medium | Arrowtech does not currently offer any competitive SPRDs | Arrowtech was founded in 1982 by FEMA. They offer a range of detectors that span across many industries including Homeland Security |
| Ashland | No | Medical, Radiography, Multiple Other | Large | Low |  | They offer a huge range of products but do not appear to be detector related |
| Beckman Coulter | No | Life Sciences | Very Large | Low |  | Healthcare, research and discovery |
| Berkeley Nucleonics Corporation | Yes | Radiation Detection | Medium | High | Offer a range of detectors; Able to create competing products; Current products are too large and bulky for active duty law enforcement | Manufacturer of electronic field‑portable radiation detectors and instruments for nuclear research. |
| Berthold | No | Nuclear, Bioanalytic | Large | Low |  | Specializes in EM (electromagnetism) detection including radiation |
| Bertin Instruments / Saphymo | Yes | Nuclear, Defense, Life Sciences, Environmental | Large | Medium |  | Many products relate to environmental monitoring but no PRDs. |
| Bruker | Yes | Detection, Biology, Medical, Multiple others | Large | High | No directly competing product at the moment | High quality detection products for a range of industries |
| Bubble Technology Industries, Inc. | Yes | Homeland Security Law Enforcement | Medium | Low | Dosimeters and large scale detection devices; no SPRD products | Multiple products for radiation protection from terrorist threats. Recently received a $3M grant ($3,339,169.28) |
| Canberra | Yes | Nuclear, Radiation Safety | Medium | Medium | Currently don’t offer many PRD or SPRDs; capability to expand into this line | Acquired by Mirion |
| Carestream Health | No | Medical, Dental | Large | Low |  | Radiology, x-ray, medical and dental equipment |
| Centronic Nuclear | Potentially | Defense, Nuclear, Aerospace, Research, Oil and Gas, Medical | Large | Low |  | Lab related equipment, not relevant to law enforcement |
| CIRS inc | Low | Medical | Large | Low | Mostly focuses on medical industry |  |
| Cividec | Potentially | Radiation Detection, Nuclear | Large | Medium |  | Range of detectors for lab usage |
| CP Medical | Potentially | Medical | Large | Low |  | Offer a range of medical device products |
| DigiRad | No | Healthcare, Nuclear | Large | Low |  | Offers mobile and on site solutions for imaging including cameras |
| Eckert & Ziegler Group | No | Nuclear, Healthcare | Large | Low |  | Offers products related to radiation therapy, isotope products, radiopharmaceuticals |
| Environics | Potentially | Multiple | Medium | Medium | They do not appear to have a directly competing product at the moment | Computerized gas flow instrumentation |
| Environmental Instruments Canada | No | Consulting, Software, Nuclear | Small | Low |  | Works in radiation safety and training has released an android app |
| Esaote | No | Medical and Healthcare | Large | Low |  | Esaote offers a range of range of equipment and software related to the medical field in including ultrasound and MRI equipment. |
| Flir | Yes | Defense, Aviation, Nuclear, Tactical, Homeland Security, Military, Multiple Others | Large | Medium |  | Flir offers imaging systems to many different firms and industries and has a range of radiation detection products. They are a major technology company in a range of industries |
| Fluke Biomedical | No | Medical | Large | Low |  | Fluke is a medical company that has a range of radiation dosimeters and safety products. They do not appear to focus on Homeland Security |
| FujiFilm Holdings | No | Healthcare and Others | Large | Low |  | FujiFilm offers a range of products and touches on radiopharmaceuticals and diagnostic equipment. |
| Gamma Pix | Potentially | Radiation Detection | Medium | Medium | Low cost solution, currently lacks sensitivity needed for preventive detection | They have created an app for mobile phones to detect radiation |
| GE Healthcare | No | Healthcare, Medical | Large | Low |  | They offer a range of medical products including those related to radiology |
| GeoRadis | Potentially | Radiation Detection | Medium | Medium |  | Products for radiation detection and EM |
| Global Medical Isotope Systems | No | Healthcare, Nuclear | Small | Low |  | Develop compact medical isotope systems |
| Hitachi Healthcare | No | Medical | Large | Low |  | Offers a range of medical products including MRI, Ultrasound and CT Equipment |
| Kromek | Yes | Radiation Detection, Nuclear | Large | High | They offer products directly related to homeland security | They are a large company with a range of detector and imaging products |
| Lab Impex Systems Ltd | Potentially | Security and Safety, Nuclear, Medical, Laboratory | Large | Medium | Analyze | They offer handheld detection devices and larger devices. Currently they don't appear to have any PRDs that would be easily adopted by Law Enforcement |
| Landauer | Potentially | Nuclear | Large | Low | No PRDs in product line | Focus on occupational radiation monitoring |
| Leidos, Inc. | Potentially | Civil, Defense, Healthcare | Large | Medium | Offers large scale radiation detection products | Leidos is a huge company with multiple products and services Leidos received a grant($5,223,410) |
| Ludlum Instruments | Potentially | Radiation Detection | Large | Medium | Industry leader for handheld radiation survey instruments; no PRDs in product line | Ludlum offers a range of products related to radiation detection |
| Merge and IBM Company | No | Healthcare, Radiology, Software | Large | Low |  | Merge is part of IBM and offers a range of healthcare products and services |
| Mirion Technologies | Yes | Nuclear, Radiation Detection | Large | High |  | A large firm offering radiation detection and safety solutions |
| Nordion | No | Healthcare | Large | Low |  | Nordion offers gamma technologies and medical isotopes relevant to the healthcare field |
| Nuclear Solutions Division | No | Consulting | Small | Low |  | Nuclear Solutions Division mainly functions as a consultant in the nuclear industry. |
| NucSafe | Potentially | Radiation Detection, Nuclear | Medium | Medium | They are in the direct industry of RadAlert but do not have any current PRDs | Offers a range of radiation detection products |
| On Site Systems | No | Software | Medium | Low |  | On Site System develops radiation related software products |
| Ortec Ametek | Potentially | Nuclear Detection | Large | Medium | Industry leader for high performance gamma-ray spectrometers; no PRDs in product line | Ortec Ametek directly manufactures multiple technologies related to radiation detectors, nuclear instrumentation and software |
| Oxford Instruments | Potentially | Instrument Manufacturing | Large | Low | They offer a range of radiation products but do not appear to have any PRDs | Oxford Instruments is a large company with products covering a range research and multiple Industries |
| Passport Systems | Potentially | Homeland Security | Large | Medium | They do not currently have many competing products but could expand into PRDs and SPRDs | Passport Systems offers large scale as well as networked portable solutions to radiation detection and protection. They work directly with the Federal Government and Homeland Security. They recently won a large grant ($4,376,707). |
| Philips Healthcare | No | Medical | Large | Low |  | Offers a range of medical products including MRI, Ultrasound and CT Equipment and Diagnostic Imaging Equipment |
| Physical Sciences, Inc. | Potentially | Gas and Radiation Detection | Large | Low | 1) Does not appear to have PRDs 2) Site was potentially hacked so I didn't explore further | They have a range of detection products related to the gas and nuclear industry. grant ($4,837,559) |
| Pico Envirotec | Potentially | Radiation, Geophysics | Medium | Medium | No current PRD | Radiation and geophysical measurement in the air or ground |
| Polimaster\* | Yes | Radiation Detection | Large | High |  | Polimaster manufactures a range of radiation detection products |
| Protean Instruments | No | Radiation Detection | Medium | Low |  | Protean builds high performance alpha and beta counting systems |
| Radcomm Systems | Potentially | Radiation Detection | Large | Medium |  | Radcomm builds radiation detection systems |
| Radiation Solutions Inc | No | Radiation Detection, Nuclear | Large | Low |  | Specialize in large vehicle-based detection systems for airplanes, helicopters, boats, etc. Appear to offer products from other manufacturers, not as primary business. |
| RAE Systems | Yes | Detection | Large | High |  | Rae Systems is a large manufacturer of detection systems. They appear to be a part of Honeywell |
| Saphymo | Potentially | Radiation Detection, Nuclear | Large | Medium |  |  |
| Sensor Technology Engineering | Yes | Radiation Detection | Small | Medium | They offer gamma and neutron handheld detectors | They have 3 different hand held radiation detectors |
| Siemens Healthcare | No | Medical | Large | Low |  | Offers medical and diagnostic equipment |
| Smiths Detection | Potentially | Detection, Inspection | Large | Medium | No current PRD | They offer a range of detection systems from small to a very large scale, but no PRDs |
| Sun Nuclear | Potentially | Medical | Large | Low | Mostly focuses on medical industry | Offers a range of products related to medical field |
| Symetrica | Potentially | Radiation Detection, Homeland Security | Large | Medium | No current PRD | They offer a range of detection products specifically for homeland security related tasks |
| Technical Associates Nuclear Instruments and Systems | Yes | Radiation Detection, Safety Systems | Large | High |  | They offer a range of radiation related products and also safety related equipment |
| The MJW Companies | No | Consulting | Medium | Low |  | They offer a rang of consulting services geared towards the nuclear industry |
| Thermo Fisher Scientific | Yes | Life Sciences | Large | High |  | Thermo Fisher Scientific is a massive company with products covering multiple industries. They specifically manufacture radiation equipment |
| Toshiba Medical | No | Technology, Healthcare | Large | Low |  | They offer a range of products including radiation products. They mostly focus their radiation products in the healthcare sector |
| Tracerco | Potentially | Radiation Detection, Nuclear | Large | Medium |  | They offer a range of detection and dosimetry equipment |
| Alpha Spectra | No | Radiation Detectors | Medium | Low |  | They are a distributor of radiation detection products |
| Atlantic Nuclear Corp | No | Nuclear, Homeland Security | Small | Low |  | Sells Instrumentation and Calibration Services |
| EcoTest | No | Retailer | Medium | Low |  | Offers a wide range of nuclear and radiation equipment |
| Fluke Biomedical | No | Medical | Large | Low |  | Fluke is a medical company that has a range of radiation dosimeters and safety products. They do not appear to focus on Homeland Security |
| FujiFilm Holdings | No | Healthcare and Others | Large | Low |  | FujiFilm offers a range of products and touches on radiopharmaceuticals and diagnostic equipment. |
| Gamma Data | No | Nuclear Industry, Science | Large | Low |  | Gamma Data is a supplier of instruments and tools related to the nuclear field and optronics |
| James Fisher Nuclear | No | Nuclear Industry | Large | Low |  | A range of nuclear industry related products and services |
| Laurus Systems Inc | No | Detection Products | Medium | Low |  | Laurus offers products related to multiple fields including hazmat, nuclear energy, oil and gas, homeland security, hospitals, military and education |
| Nuclear Technology Services, Inc. | No | Consulting | Small | Low |  | Offer books, software and consulting related to nuclear industry |
| Owens Scientific Inc | Potentially | Radiation Detection, Nuclear | Medium | Low |  | Sells a range of radiation related products |
| Qaltek | No | Radiation, Consulting, Nuclear | Medium | Low |  | Qaltek distributes radiation products and also works in consulting and installation |
| Radiation Detection Co | No | Dosimetry | Medium | Low |  | Radetco offers dosimetry solutions to a range of industries |
| Shimadzu | No | Healthcare, Medical | Large | Low |  | Medical Related Distributor |
| Southern Scientific LTD | Potentially | Radiation Detection, Nuclear | Large | Low |  | Offers a range of products some related to homeland security but it appears they are mostly a distributor |

**Appendix 4: Competitor Analysis**

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Arrow Tech | DMC 2000GN Electronic Dosimeter, Gamma & Neutron | PRD |  | Potentially | Yes | Yes | No Gamma Spectrum |
| Arrow Tech | DMC 3000 Electronic Personal Dosimeter, X-ray & Gamma | PRD |  | Potentially | Yes | No | 1) No Gamma Spectrum 2) This appears to be the exact same detector as the Mirion DMC 3000 |
| Arrow Tech | RAD-60R Personal Electronic Dosimeter | PRD |  | Potentially | Yes | No | No Gamma Spectrum |
| Berkeley Nucleonics Corporation | Model 945- SAM III Isotope Identifier with Reachback | Handheld |  | Potentially | Yes | Optional | 1) Smartphone based application combined with detector |
| Berkeley Nucleonics Corporation | Model 950- Ruggedized Isotope Identifier | Handheld |  | Potentially | Yes |  | 1) Detects and identifies radionuclides 2) Meets ANSI 42.34 Standards 3) Patented Smartphone based hand-held RIID |
| Bubble Technology Industries, Inc. | RadCompass | Handheld |  | Potentially | Yes |  | 1) Offers a handheld detector with location based source finding |
| Canberra | UltraRadiac-Plus Personal Radiation Monitor | Handheld |  | Potentially | Yes |  | 1) Made to be used in extreme environments |
| Environmental Instruments Canada | GammaGuard | Handheld |  | Potentially | Yes |  | This is an application that runs on the users phone |
| FLIR | identiFINDER R100 | PRD |  | Yes | Yes |  |  |
| FLIR | identiFINDER R200 | SPRD |  | Yes | Yes |  |  |
| FLIR | identiFINDER R300 | SPRD | $9,950 | Yes | Yes | Optional |  |
| Kromek | D3S | Handheld |  | Yes | Yes | Yes | 1) Thermal neutron scintillator detector and CsI(Tl) gamma detector 2) Bluetooth Connectivity 3) Integrates with phone |

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Mirion Technologies | DMC 2000 GN | Neutron Dosimeter | PRD |  | No | Yes | Yes | 1) This appears to be the same as the Arrow Tech DMC 2000 GN |
| Mirion Technologies | DMC 3000 PRD Module | PRD |  | Potentially |  |  | Radiation Counting |
| Mirion Technologies | PDS GO | PRD |  | Yes | Yes |  |  |
| Mirion Technologies\* | PDS-100GN | PRD | PRD | $3,000 | Yes | Yes | Yes | Separate Gamma and Neutron Channel |
| Mirion Technologies\* | PDS-100GN/ID | Spectroscopic Personal Radiation Detector (SPRD) | SPRD | $4,950 | Yes | Yes | Yes | 1) Can distinguish types of radiation on the spot (NORM, Background, SNM) |
| Passport Systems | G300 SmartShield | Handheld |  | Yes | Yes |  | 1) Allows for Geolocation of radiological sources 2) Can be linked to other detectors 3) Adds Map Functionality 4) Has three parts detector, phone and master software application |
| Polimaster | Gamma Personal Radiation Detector PM1401GNB | SPRD | $4,800 | Yes | Yes | Yes | 1) Detect and identify radioactive and nuclear materials |
| Polimaster | Gamma Personal Radiation Detector PM1401MB | SPRD |  | Yes | Yes | Yes | 1) Detect and identify radioactive and nuclear materials |
| Polimaster | Personal Combined Radiation Detectors/Dosimeters PM1703MO-1A | SPRD |  | Yes | Yes |  | 1) Bluetooth Connectivity 2) Isotope Identification 3) Networking Software |
| Polimaster | Personal Combined Radiation Detectors/Dosimeters PM1703MO-1B | SPRD |  | Yes | Yes |  | 1) Bluetooth Connectivity 2) Isotope Identification 3) Networking Software |

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Polimaster | Personal Radiation Detectors PM1703 GNB | SPRD |  | Yes | Yes | Yes | 1) Has gamma detection and neutron detection 2) Uses Csi(TI) for gamma and LiL(Eu) for neutron 3) Bluetooth Connectivity 4) Isotope Identification 5) Networking Software |
| Polimaster | Personal Radiation Detectors PM1703 MB | SPRD | $4,312 | Yes | Yes | Yes | 1) Has gamma detection and neutron detection 2) Uses Csi(TI) for gamma and LiL(Eu) for neutron 3) Bluetooth Connectivity 4) Isotope Identification 5) Networking Software |
| Polimaster | PM1401GNA | PRD | $3,667 | Yes | Yes | Yes | 1) Portable detector can search for gamma and neutron radiation |
| Polimaster | PM1401MA/MB | PRD |  | Yes | Yes |  | 1) Can detect gamma even if shielded 2) Designed to be used in harsh environments |
| Polimaster | PM140GNB | PRD |  | Yes | Yes | Yes | 1) Portable detector can search for gamma and neutron radiation |
| Polimaster | PM1701M | PRD |  | Yes | Yes |  | 1) Able to distinguish between background radiation |
| Polimaster | PM1703GN | PRD | $2,933 | Yes | Yes | Yes | 1) Can search for radioactive and nuclear materials |
| Polimaster | PM1703GNA | PRD | $3,389 | Yes | Yes | Yes | 1) Can search for radioactive and nuclear materials |

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Polimaster | PM1703GNB | PRD | $3,200 | Yes | Yes | Yes | 1) Can search for radioactive and nuclear materials |
| Polimaster | PM1703GNM | PRD |  | Yes | Yes | Yes | 1) Can search for radioactive and nuclear materials |
| Polimaster | PM1703M/MA/MB | PRD |  | Yes | Yes |  | 1) Can search for gamma and provide dose rates |
| Polimaster | PM1703MO-1/MO-2/MO-1BT | PRD |  | Yes | Yes |  | 1) Has two detection modules 2) Can search for gamma and provide dose rates |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 (Basic) | SPRD |  | Yes | Yes |  | 1) Has CsI(TI) scintillator and creates gamma-spectra 2) Identify sources |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 A-GN | SPRD |  | Yes | Yes | Yes | 1) Has two detectors spectroscopic gamma (CsI(TI) and neutron detector |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 A-GNM | SPRD | $4,187 | Yes | Yes | Yes | 1) Has three detectors two for gamma and one for neutrons CsI(Tl), GM tube and Li6I(Eu) |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 A-M | SPRD |  | Yes | Yes |  | 1) Equipped with two gamma-detectors spectroscopic CsI(Tl) and GM tube 2) Has a long range to measure exposure and rate |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 GN | SPRD | $3,987 | Yes | Yes | Yes | 1) Adds Li6I(Eu) detector for neutrons |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704 M | SPRD |  | Yes | Yes |  | 1) Adds a GM tube to expand dose rate measurement over basic version |

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Polimaster | Spectroscopic Personal Radiation Detectors PM1704A | SPRD | $3,987 | Yes | Yes |  | 1) Basic gamma model with spectroscopic CsI(Tl) detector |
| Radcomm Systems | Mspec | Handheld |  | Yes | Yes |  | 1) Appears to be more for scanning material to check for and categorize categorizes the result as Industrial, Medical or NORM |
| RAE Systems | DoseRAE Pro | Handheld |  | Potentially | Yes |  | 1) For response to gamma ray threats |
| RAE Systems | GammaRAE II R | PRD |  | Yes | Yes |  | 1) For first responders has BlueTooth connectivity and can allows real time threat monitoring with ProRAE Guardian software |
| RAE Systems | NeutronRAE II | PRD | $2,995 | Yes | Yes | Yes |  |
| Saphymo | MiniTRACE Gamma S10 / S100 | Handheld |  | Yes | Yes |  | 1) Detector that can be used for homeland security purposes |
| Sensor Technology Engineering | HRM-Handheld Radiation Monitor | Handheld | $5,500 | Yes | yes | Yes | 1) Can detect gamma and thermal neutrons |
| Sensor Technology Engineering | Radiation Pager | Handheld |  | Yes | yes |  | 1) Detector with PM tube and Scintillator |
| Sensor Technology Engineering | Radiation Pager-S | Handheld |  | Yes | yes |  | 1) More advanced version of the original Radiation Pager |
| Technical Associates Nuclear Instruments and Systems | DSI-2GN | PRD | $3,950 | Yes | Yes | Yes | 1) Uses a BGO Scintillator |
| Thermo Fisher Scientific | RadEy GF/GF-10 Personal Radiation Detectors | Handheld |  | Potentially | Yes |  |  |
| Thermo Fisher Scientific | RadEye B20 and B20-ER Multi-Purpose Survey Meters | Handheld |  | Potentially | Yes | no |  |

**Appendix 4.1:** Detailed Competitor and Individual Product Analysis (continued)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Company** | **Detector name** | **Type** | **Price** | **Potential Competitor** | **Gamma** | **Neutron** | **Notes** |
| Thermo Fisher Scientific | RadEye G Ex series Personal Radiation Detectors | Handheld |  | Yes | Yes |  | 1) For use in environments that may have explosives present |
| Thermo Fisher Scientific | RadEye G/G-10 Personal Dose Rate Meters | Handheld |  | Yes | Yes |  | 1) For first responders to measure gamma and x-ray dose rates |
| Thermo Fisher Scientific | RadEye GN Gamma Neutron Pagers | PRDs | $3,250 | Yes | Yes | Yes |  |
| Thermo Fisher Scientific | RadEye GN+ Gamma Neutron Pagers | PRDs | $3,950 | Yes | Yes | Yes |  |
| Thermo Fisher Scientific | RadEye NL Personal Highly Sensitive Neutron Radiation Detectors | PRD | $2,420 | No | No | Yes | 1) This is just a neutron detector |
| Thermo Fisher Scientific | RadEye SPRD-GN Spectroscopic Personal Radiation Detector | SPRD | $5,000 | Yes | Yes | Yes | 1) Similar to RadEye SPRD but can detect thermal neutrons |
| Thermo Fisher Scientific | RadEye X Series Survey Meters | Handheld |  | Potentially | Yes |  | 1) Essentially operates as a survey meter |
| Thermo Fisher Scientific | RadEyeSPRD Spectroscopic Personal Radiation Detector | SPRD | $3,950 | Yes | Yes | No | 1) This is a SPRD that could be a direct competitor |

**Appendix 5: Overall Schedule (5 year plan)**

**Appendix 6: Management and Human Resources**

**Appendix 7: Operations Plan**

**Appendix 7.1:** Estimated Salary Levels and Total Compensation

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Employee Type** | **Level** | **Salary (Low)** | **Salary (High)** | **Benefits (raw)** | **Benefits (adjusted)** | **Total Compensation (Low)** | **Total Compensation (High)** | **Optional Benefits** |
| CEO | 1 | $15,000 | $450,000 | $65,625 | $21,875 | $140,625 | $515,625 | Equity |
| CEO | 2 | $15,000 | $550,000 | $79,375 | $26,250 | $164,375 | $629,375 | Equity |
| CEO | 3 | $20,000 | $650,000 | $93,750 | $43,750 | $193,750 | $743,750 | Equity |
| CTO | 1 | $15,000 | $350,000 | $53,125 | $20,625 | $128,125 | $403,125 | Equity |
| CTO | 2 | $15,000 | $400,000 | $60,000 | $25,000 | $140,000 | $460,000 | Equity |
| CTO | 3 | $20,000 | $450,000 | $68,125 | $36,875 | $163,125 | $518,125 | Equity |
| VP of Sales | 1 | $15,000 | $300,000 | $46,875 | $20,625 | $121,875 | $346,875 | Stock |
| VP of Sales | 2 | $15,000 | $350,000 | $53,750 | $25,000 | $133,750 | $403,750 | Stock |
| VP of Sales | 3 | $15,000 | $400,000 | $61,875 | $36,875 | $156,875 | $461,875 | Stock |
| VP of Engineering | 1 | $15,000 | $300,000 | $46,875 | $20,625 | $121,875 | $346,875 | Stock |
| VP of Engineering | 2 | $15,000 | $350,000 | $53,750 | $25,000 | $133,750 | $403,750 | Stock |
| VP of Engineering | 3 | $20,000 | $400,000 | $61,875 | $36,875 | $156,875 | $461,875 | Stock |
| Engineer | 1 | $60,000 | $125,000 | $23,125 | $18,750 | $83,125 | $148,125 | Stock |
| Engineer | 2 | $70,000 | $150,000 | $27,500 | $23,750 | $97,500 | $177,500 | Stock |
| Engineer | 3 | $85,000 | $175,000 | $32,500 | $33,125 | $117,500 | $207,500 | Stock |
| Sales | 1 | $35,000 | $100,000 | $16,875 | $12,500 | $51,875 | $116,875 | Commission + Stock |
| Sales | 2 | $45,000 | $110,000 | $19,375 | $15,625 | $64,375 | $129,375 | Commission + Stock |
| Sales | 3 | $60,000 | $120,000 | $22,500 | $22,500 | $82,500 | $142,500 | Commission + Stock |
| Administrative Assistant | 1 | $35,000 | $70,000 | $13,125 | $15,625 | $48,125 | $83,125 | Stock |
| Administrative Assistant | 2 | $40,000 | $75,000 | $14,375 | $15,625 | $54,375 | $89,375 | Stock |
| Administrative Assistant | 3 | $45,000 | $80,000 | $15,625 | $15,625 | $60,625 | $95,625 | Stock |
| IT Staff | 1 | $60,000 | $125,000 | $23,125 | $18,750 | $83,125 | $148,125 | Stock |
| IT Staff | 2 | $70,000 | $150,000 | $27,500 | $23,750 | $97,500 | $177,500 | Stock |
| IT Staff | 3 | $85,000 | $175,000 | $32,500 | $33,125 | $117,500 | $207,500 | Stock |

**Appendix 7.2:** Yearly Budget Allocation for $100k and $75k

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$100 K** | |  | **$75 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $45,000 |  | CEOe | $25,000 |
| Contract Labor (1099) |  |  | Contract Labor (1099) |  |
| Electrical Engineer | $12,000 |  | Electrical Engineer | $12,000 |
| Nuclear Engineer | $6,000 |  | Nuclear Engineer | $6,000 |
| Engineering Supplies | $7,000 |  | Engineering Supplies | $7,000 |
| Equipment | $5,000 |  | Equipment | $2,600 |
| Software | $5,000 |  | Software | $5,000 |
| Office Rent | $4,800 |  | Office Rent | $4,800 |
| Utilities ($200/month) | $2,400 |  | Utilities ($200/month) | $2,400 |
| Office Supplies | $1,000 |  | Office Supplies | $1,000 |
| Travel | $4,200 |  | Travel | $4,200 |
| Legal Fees | $7,600 |  | Legal Fees | $5,000 |
| **TOTAL** | **$100,000** |  | **TOTAL** | **$75,000** |

**Appendix 7.3:** Yearly Budget Allocation for $200k and $150k

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$200 K** | |  | **$150 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $64,000 |  | CEOe | $48,000 |
| Contract Labor (1099) |  |  | Contract Labor (1099) |  |
| Electrical Engineer | $30,000 |  | Electrical Engineer | $15,000 |
| Nuclear Engineer | $12,000 |  | Nuclear Engineer | $6,000 |
| Design Engineer | $4,000 |  | Design Engineer | $4,000 |
| Manufacturing Engineer | $8,000 |  | Manufacturing Engineer | $8,000 |
| Graphic Designer | $2,000 |  | Engineering Supplies | $12,000 |
| Engineering Supplies | $23,000 |  | Equipment | $8,000 |
| Equipment | $8,000 |  | Software | $7,400 |
| Software | $7,200 |  | Office Rent | $18,000 |
| Office Rent | $18,000 |  | Utilities ($600/month) | $7,200 |
| Utilities ($600/month) | $7,200 |  | Liability Insurance | $1,000 |
| Liability Insurance | $1,000 |  | Office Supplies | $2,000 |
| Office Supplies | $2,000 |  | Travel | $8,400 |
| Travel | $8,600 |  | Legal Fees | $5,000 |
| Legal Fees | $5,000 |  | **TOTAL** | **$150,000** |
| **TOTAL** | **$200,000** |  |  |  |
|  |  |  |  |  |

**Appendix 7.4:** Yearly Budget Allocation for $300K and $250K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$300 K** | |  | **$250 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $70,000 |  | CEOe | $60,000 |
| Engineer | $80,000 |  | Engineer | $70,000 |
| Contract Labor (1099) |  |  | Contract Labor (1099) |  |
| Electrical Engineer | $30,000 |  | Electrical Engineer | $20,000 |
| Nuclear Engineer | $15,000 |  | Nuclear Engineer | $6,000 |
| Design Engineer | $4,000 |  | Design Engineer | $4,000 |
| Manufacturing Engineer | $8,000 |  | Manufacturing Engineer | $8,000 |
| Graphic Designer | $4,000 |  | Graphic Designer | $2,000 |
| Engineering Supplies | $23,000 |  | Engineering Supplies | $23,000 |
| Equipment | $10,000 |  | Equipment | $8,000 |
| Software | $7,200 |  | Software | $7,200 |
| Office Rent | $18,000 |  | Office Rent | $18,000 |
| Utilities ($600/month) | $7,200 |  | Utilities ($600/month) | $7,200 |
| Liability Insurance | $1,000 |  | Liability Insurance | $1,000 |
| Office Supplies | $2,000 |  | Office Supplies | $2,000 |
| Travel | $8,600 |  | Travel | $8,600 |
| Legal Fees | $12,000 |  | Legal Fees | $5,000 |
| **TOTAL** | **$300,000** |  | **TOTAL** | **$250,000** |
|  |  |  |  |  |

**Appendix 7.5:** Yearly Budget Allocation for $400K and $350K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$400 K** | |  | **$350 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $75,000 |  | CEOe | $70,000 |
| Engineer | $85,000 |  | Engineer | $80,000 |
| Account Executive | $75,000 |  | Account Executive | $75,000 |
| Contract Labor (1099) |  |  | Contract Labor (1099) |  |
| Electrical Engineer | $30,000 |  | Electrical Engineer | $9,400 |
| Nuclear Engineer | $10,000 |  | Nuclear Engineer | $2,000 |
| Design Engineer | $4,000 |  | Design Engineer | $2,000 |
| Manufacturing Engineer | $8,000 |  | Manufacturing Engineer | $2,000 |
| Graphic Designer | $4,400 |  | Graphic Designer | $1,000 |
| Engineering Supplies | $23,000 |  | Engineering Supplies | $23,000 |
| Equipment | $8,000 |  | Equipment | $8,000 |
| Software | $7,200 |  | Software | $7,200 |
| Office Rent | $24,000 |  | Office Rent | $24,000 |
| Utilities ($600/month) | $9,600 |  | Utilities ($800/month) | $9,600 |
| Liability Insurance | $2,000 |  | Liability Insurance | $2,000 |
| Office Supplies | $4,000 |  | Office Supplies | $4,000 |
| Travel | $16,800 |  | Travel | $16,800 |
| Legal Fees | $14,000 |  | Legal Fees | $14,000 |
| **TOTAL** | **$400,000** |  | **TOTAL** | **$350,000** |

**Appendix 7.6:** Yearly Budget Allocation for $600K and $500K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$600 K** | |  | **$500 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $120,000 |  | CEOe | $100,000 |
| Engineer | $100,000 |  | Engineer | $85,000 |
| Engineer | $100,000 |  | Engineer | $85,000 |
| Account Executive | $80,000 |  | Account Executive | $75,000 |
| Administrative Assistant | $50,000 |  | Contract Labor (1099) |  |
| Contract Labor (1099) |  |  | Electrical Engineer | $15,000 |
| Electrical Engineer | $19,400 |  | Nuclear Engineer | $6,000 |
| Nuclear Engineer | $8,000 |  | Design Engineer | $2,000 |
| Design Engineer | $4,000 |  | Manufacturing Engineer | $4,000 |
| Manufacturing Engineer | $8,000 |  | Graphic Designer | $4,000 |
| Graphic Designer | $2,000 |  | Engineering Supplies | $26,000 |
| Engineering Supplies | $23,000 |  | Equipment | $10,000 |
| Equipment | $8,000 |  | Software | $7,200 |
| Software | $7,200 |  | Office Rent | $24,000 |
| Office Rent | $24,000 |  | Utilities ($600/month) | $9,600 |
| Utilities ($800/month) | $9,600 |  | Liability Insurance | $2,000 |
| Liability Insurance | $2,000 |  | Office Supplies | $6,000 |
| Office Supplies | $4,000 |  | Travel | $25,200 |
| Travel | $16,800 |  | Legal Fees | $14,000 |
| Legal Fees | $14,000 |  | **TOTAL** | **$500,000** |
| **TOTAL** | **$600,000** |  |  |  |

**Appendix 7.7:** Yearly Budget Allocation for $800K and $700K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$800 K** | |  | **$700 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $120,000 |  | CEOe | $120,000 |
| Engineer | $110,000 |  | Engineer | $100,000 |
| Engineer | $110,000 |  | Engineer | $100,000 |
| Account Executive | $85,000 |  | Account Executive | $80,000 |
| Account Executive | $85,000 |  | Account Executive | $80,000 |
| Administrative Assistant | $70,000 |  | Administrative Assistant | $50,000 |
| Contract Labor (1099) |  |  | Contract Labor (1099) |  |
| Electrical Engineer | $35,000 |  | Electrical Engineer | $25,000 |
| Nuclear Engineer | $10,000 |  | Nuclear Engineer | $8,000 |
| Design Engineer | $6,000 |  | Design Engineer | $4,000 |
| Manufacturing Engineer | $8,000 |  | Manufacturing Engineer | $8,000 |
| Graphic Designer | $4,000 |  | Graphic Designer | $4,000 |
| Engineering Supplies | $23,000 |  | Engineering Supplies | $23,000 |
| Equipment | $20,000 |  | Equipment | $8,000 |
| Software | $14,000 |  | Software | $7,200 |
| Office Rent | $31,200 |  | Office Rent | $31,200 |
| Utilities ($1000/month) | $12,000 |  | Utilities ($800/month) | $9,600 |
| Liability Insurance | $2,000 |  | Liability Insurance | $2,000 |
| Office Supplies | $5,000 |  | Office Supplies | $5,000 |
| Travel | $33,600 |  | Travel | $21,000 |
| Legal Fees | $16,200 |  | Legal Fees | $14,000 |
| **TOTAL** | **$800,000** |  | **TOTAL** | **$700,000** |

**Appendix 7.7:** Yearly Budget Allocation for $1M and $900K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$1 M** | |  | **$900 K** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $140,000 |  | CEOe | $120,000 |
| Engineer | $120,000 |  | Engineer | $110,000 |
| Engineer | $120,000 |  | Engineer | $110,000 |
| Engineer | $120,000 |  | Engineer | $110,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Administrative Assistant | $75,000 |  | Administrative Assistant | $75,000 |
| Interns | $40,000 |  | Contract Labor (1099) |  |
| Contract Labor (1099) |  |  | Electrical Engineer | $20,000 |
| Electrical Engineer | $20,000 |  | Nuclear Engineer | $10,000 |
| Nuclear Engineer | $10,000 |  | Design Engineer | $6,000 |
| Design Engineer | $6,000 |  | Manufacturing Engineer | $8,000 |
| Manufacturing Engineer | $8,000 |  | Graphic Designer | $4,000 |
| Graphic Designer | $4,000 |  | Engineering Supplies | $23,000 |
| Engineering Supplies | $23,000 |  | Equipment | $20,000 |
| Equipment | $20,000 |  | Software | $14,000 |
| Software | $16,000 |  | Office Rent | $31,200 |
| Office Rent | $32,000 |  | Utilities ($800/month) | $12,000 |
| Utilities ($800/month) | $12,000 |  | Liability Insurance | $2,000 |
| Liability Insurance | $2,400 |  | Office Supplies | $5,000 |
| Office Supplies | $8,000 |  | Travel | $33,600 |
| Travel | $33,600 |  | Legal Fees | $16,200 |
| Legal Fees | $20,000 |  | **TOTAL** | **$900,000** |
| **TOTAL** | **$1,000,000** |  |  |  |

**Appendix 7.8:** Yearly Budget Allocation for $1.5M and $1.25M

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$1.5 M** | |  | **$1.25 M** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $140,000 |  | CEOe | $140,000 |
| CTO | $140,000 |  | CTO | $120,000 |
| Senior Electrial Engineer | $140,000 |  | ElectricalEngineer | $120,000 |
| Electrical Engineer | $120,000 |  | ElectricalEngineer | $120,000 |
| ElectricalEngineer | $120,000 |  | ElectricalEngineer | $120,000 |
| Software Engineer | $120,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Administrative Assistant | $75,000 |
| Administrative Assistant | $75,000 |  | Interns | $40,000 |
| Administrative Assistant | $75,000 |  | Contract Labor (1099) |  |
| Interns | $40,000 |  | Electrical Engineer | $37,000 |
| Contract Labor (1099) |  |  | Nuclear Engineer | $10,000 |
| Electrical Engineer | $18,600 |  | Design Engineer | $6,000 |
| Nuclear Engineer | $10,000 |  | Manufacturing Engineer | $20,000 |
| Design Engineer | $6,000 |  | Graphic Designer | $20,000 |
| Manufacturing Engineer | $20,000 |  | Engineering Supplies | $23,000 |
| Graphic Designer | $20,000 |  | Equipment | $20,000 |
| Engineering Supplies | $30,000 |  | Software | $16,000 |
| Equipment | $30,000 |  | Office Rent | $32,000 |
| Software | $20,000 |  | Utilities ($1000/month) | $12,000 |
| Office Rent | $32,000 |  | Liability Insurance | $2,400 |
| Utilities ($1000/month) | $12,000 |  | Office Supplies | $8,000 |
| Liability Insurance | $2,400 |  | Travel | $33,600 |
| Office Supplies | $12,000 |  | Legal Fees | $20,000 |
| Travel | $42,000 |  | **TOTAL** | **$1,250,000** |
| Legal Fees | $20,000 |  |  |  |
| **TOTAL** | **$1,500,000** |  |  |  |

**Appendix 7.9:** Yearly Budget Allocation for $2.5M and $1.75M

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$2.5 M** | |  | **$1.75 M** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $175,000 |  | CEOe | $160,000 |
| CTOe | $160,000 |  | CTO | $140,000 |
| CFOe | $160,000 |  | CFO | $140,000 |
| VP of Engineeringe | $150,000 |  | Senior Electrial Engineer | $140,000 |
| VP of Salese | $150,000 |  | Electrical Engineer | $120,000 |
| Senior Electrical Engineer | $140,000 |  | ElectricalEngineer | $120,000 |
| Nuclear Engineer | $130,000 |  | Software Engineer | $120,000 |
| Electrical Engineer | $130,000 |  | Account Executive | $85,000 |
| Electrical Engineer | $130,000 |  | Account Executive | $85,000 |
| Electrical Engineer | $130,000 |  | Account Executive | $85,000 |
| Software Engineer | $120,000 |  | Administrative Assistant | $75,000 |
| Business/Accountant | $100,000 |  | Administrative Assistant | $75,000 |
| Account Executive | $85,000 |  | Interns | $60,000 |
| Account Executive | $85,000 |  | Contract Labor (1099) |  |
| Account Executive | $85,000 |  | Electrical Engineer | $26,000 |
| Administrative Assistant | $70,000 |  | Nuclear Engineer | $20,000 |
| Interns | $60,000 |  | Design Engineer | $6,000 |
| Contract Labor |  |  | Manufacturing Engineer | $8,000 |
| Electrical Engineer | $30,000 |  | Graphic Designer | $12,000 |
| Nuclear Engineer | $7,000 |  | Engineering Supplies | $36,400 |
| Design Engineer | $10,000 |  | Equipment | $40,000 |
| Manufacturing Engineer | $10,000 |  | Software | $28,800 |
| Graphic Designer | $10,000 |  | Office Rent | $48,000 |
| Engineering Supplies | $36,400 |  | Utilities ($1200/month) | $14,400 |
| Equipment | $40,000 |  | Liability Insurance | $4,800 |
| Software | $28,800 |  | Office Supplies | $16,000 |
| Office Rent | $48,000 |  | Travel | $54,600 |
| Utilities ($1800/month) | $21,600 |  | Legal Fees | $30,000 |
| Liability Insurance | $12,000 |  | **TOTAL** | **$1,750,000** |
| Office Supplies | $32,000 |  |  |  |
| Travel | $109,200 |  |  |  |
| Legal Fees | $45,000 |  |  |  |
| **TOTAL** | **$2,500,000** |  |  |  |

**Appendix 7.10:** Yearly Budget Allocation for $3.75M and $3M

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$3.75 M** | |  | **$3 M** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $175,000 |  | CEOe | $175,000 |
| CTOe | $160,000 |  | CTOe | $160,000 |
| CFOe | $160,000 |  | CFOe | $160,000 |
| CMOe | $160,000 |  | CMOe | $160,000 |
| VP of Engineeringe | $150,000 |  | VP of Engineeringe | $150,000 |
| VP of Salese | $150,000 |  | VP of Salese | $150,000 |
| Senior Electrical Engineer | $140,000 |  | Senior Electrical Engineer | $140,000 |
| Nuclear Engineer | $130,000 |  | Nuclear Engineer | $130,000 |
| Electrical Engineer | $130,000 |  | Electrical Engineer | $130,000 |
| Electrical Engineer | $130,000 |  | Electrical Engineer | $130,000 |
| Electrical Engineer | $130,000 |  | Electrical Engineer | $130,000 |
| Electrical Engineer | $130,000 |  | Electrical Engineer | $130,000 |
| Electrical Engineer | $130,000 |  | Software Engineer | $120,000 |
| Software Engineer | $120,000 |  | Software Engineer | $120,000 |
| Software Engineer | $120,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Account Executive | $85,000 |
| Account Executive | $85,000 |  | Administrative Assistant | $70,000 |
| Administrative Assistant | $70,000 |  | Interns | $80,000 |
| Finance/Accounting | $100,000 |  | Contract Labor | $40,000 |
| Human Resources | $95,000 |  | Engineering Supplies | $46,000 |
| IT Staff | $120,000 |  | Equipment | $45,400 |
| Marketing | $75,000 |  | Software | $36,000 |
| Office Manager | $120,000 |  | Office Rent | $52,800 |
| Interns | $80,000 |  | Utilities | $21,600 |
| Contract Labor | $40,000 |  | Liability Insurance | $12,000 |
| Engineering Supplies | $46,000 |  | Office Supplies | $32,000 |
| Equipment | $45,400 |  | Travel | $109,200 |
| Software | $36,000 |  | Legal Fees | $45,000 |
| Office Rent | $52,800 |  | **TOTAL** | **$3,000,000** |
| Utilities | $21,600 |  |  |  |
| Liability Insurance | $12,800 |  |  |  |
| Office Supplies | $32,000 |  |  |  |
| Travel | $218,400 |  |  |  |
| Legal Fees | $45,000 |  |  |  |
| **TOTAL** | **$3,750,000** |  |  |  |

**Appendix 7.11:** Yearly Budget Allocation for $5M and $4M

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$5 M** | |  | **$4 M** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $200,000 |  | CEOe | $195,000 |
| CTOe | $180,000 |  | CTOe | $180,000 |
| CFOe | $180,000 |  | CFOe | $180,000 |
| CMOe | $180,000 |  | CMOe | $180,000 |
| VP of Engineering | $160,000 |  | VP of Engineeringe | $160,000 |
| VP of Salese | $160,000 |  | VP of Salese | $160,000 |
| Senior Engineer | $155,000 |  | Senior Electrical Engineer | $155,000 |
| Nuclear Engineer | $140,000 |  | Nuclear Engineer | $140,000 |
| Electrical Engineer (6) | $840,000 |  | Electrical Engineer (5) | $700,000 |
| Software Engineer (3) | $390,000 |  | Software Engineer (3) | $390,000 |
| Account Executive (6) | $510,000 |  | Account Executive (5) | $425,000 |
| Administrative Assistant | $70,000 |  | Administrative Assistant | $70,000 |
| Graphic Designer | $70,000 |  | Finance/Accounting | $100,000 |
| Finance/Accounting | $100,000 |  | Human Resources | $95,000 |
| Human Resources | $95,000 |  | IT Staff | $120,000 |
| IT and Web | $120,000 |  | Marketing | $75,000 |
| Marketing | $100,000 |  | Office Manager | $120,000 |
| Office Manager | $120,000 |  | Interns | $80,000 |
| Interns | $95,000 |  | Contract Labor | $35,000 |
| Contract Labor | $60,000 |  | Engineering Supplies | $46,000 |
| Engineering Supplies | $95,000 |  | Equipment | $45,400 |
| Equipment | $65,000 |  | Software | $42,000 |
| Software | $96,000 |  | Office Rent | $62,400 |
| Office Rent | $168,000 |  | Utilities | $36,000 |
| Utilities | $48,000 |  | Liability Insurance | $12,000 |
| Liability Insurance | $22,200 |  | Office Supplies | $32,000 |
| Office Supplies | $64,000 |  | Travel | $119,200 |
| Travel | $436,800 |  | Legal Fees | $45,000 |
| Legal Fees | $80,000 |  | **TOTAL** | **$4,000,000** |
| **TOTAL** | **$5,000,000** |  |  |  |

**Appendix 7.12:** Yearly Budget Allocation for $7.5M and $6M

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **$7.5 M** | |  | **$6 M** | |
| **Item** | **Budget** |  | **Item** | **Budget** |
| CEOe | $240,000 |  | CEOe | $200,000 |
| CTOe | $200,000 |  | CTOe | $180,000 |
| CFOe | $200,000 |  | CFOe | $180,000 |
| CMOe | $200,000 |  | CMOe | $180,000 |
| VP of Engineering | $180,000 |  | VP of Engineering | $160,000 |
| VP of Salese | $180,000 |  | VP of Salese | $160,000 |
| Senior Engineer | $170,000 |  | Senior Engineer | $155,000 |
| Nuclear Engineer (3) | $420,000 |  | Nuclear Engineer (2) | $280,000 |
| Electrical Engineer (9) | $1,260,000 |  | Electrical Engineer (8) | $1,120,000 |
| Software Engineer (5) | $725,000 |  | Software Engineer (4) | $540,000 |
| Account Executive (9) | $810,000 |  | Account Executive (8) | $720,000 |
| Administrative Assistant (2) | $160,000 |  | Administrative Assistant (2) | $160,000 |
| Finance/Accounting (2) | $200,000 |  | Graphic Designer | $70,000 |
| Graphic Designer | $70,000 |  | Finance/Accounting (2) | $200,000 |
| Finance/Accounting (2) | $200,000 |  | Human Resources | $95,000 |
| Human Resources | $95,000 |  | IT Staff | $120,000 |
| IT Staff | $120,000 |  | IT and Web | $120,000 |
| IT and Web | $120,000 |  | Marketing | $100,000 |
| Marketing (2) | $200,000 |  | Office Manager | $120,000 |
| Office Manager | $120,000 |  | Interns | $80,000 |
| Interns | $140,000 |  | Contract Labor | $10,000 |
| Contract Labor | $78,800 |  | Engineering Supplies | $80,000 |
| Engineering Supplies | $100,000 |  | Equipment | $65,000 |
| Equipment | $120,000 |  | Software | $86,000 |
| Software | $120,000 |  | Office Rent | $168,000 |
| Office Rent | $168,000 |  | Utilities | $48,000 |
| Utilities | $60,000 |  | Liability Insurance | $22,200 |
| Liability Insurance | $28,000 |  | Office Supplies | $64,000 |
| Office Supplies | $80,000 |  | Travel | $436,800 |
| Travel | $655,200 |  | Legal Fees | $80,000 |
| Legal Fees | $80,000 |  | **TOTAL** | **$6,000,000** |
| **TOTAL** | **$7,500,000** |  |  |  |

**Appendix 8: Marketing and Sales Strategy**

**Appendix 9: Financial and Economic Details**

**Appendix 10: Legal, Intellectual Property and Ethical Issues**

*\*This investment offer is intended as a guideline and if a legal offer is entered into this will be handled by RadAlert, the investor and their attorneys. The finalized offer will be the legal basis of all future dealings. Nothing in this document should be considered legally binding or intended as an offer. All negotiations will be finalized with the help of legal counsel and those legal documents will be the basis of all future dealings.*

**Appendix 11: Company Risks**

**Appendix 12: Venture Offering**

**Appendix 12.4:** Potential Venture Offerings

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Offering 1** | **Offering 2** | **Offering 3** |
| **Investment Amount** | $150,000 | $250,000 | $500,000 |
| **Equity** | 10% | 16% | 20% |
| **Firm Valuation** | $1,500,000 | $1,562,000 | $2,500,000 |

**Appendix 12.1:** Investor Equity and Firm Valuation

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Investment Amount** | **10%** | **15%** | **20%** | **25%** | **30%** | **35%** | **40%** | **45%** | **50%** |
| **$150,000** | $1,500,000 | $1,000,000 | $750,000 | $600,000 | $500,000 | $428,571 | $375,000 | $333,333 | $300,000 |
| **$250,000** | $2,500,000 | $1,666,667 | $1,250,000 | $1,000,000 | $833,333 | $714,286 | $625,000 | $555,556 | $500,000 |
| **$500,000** | $5,000,000 | $3,333,333 | $2,500,000 | $2,000,000 | $1,666,667 | $1,428,571 | $1,250,000 | $1,111,111 | $1,000,000 |
| **$1,000,000** | $10,000,000 | $6,666,667 | $5,000,000 | $4,000,000 | $3,333,333 | $2,857,143 | $2,500,000 | $2,222,222 | $2,000,000 |
| **$1,500,000** | $15,000,000 | $10,000,000 | $7,500,000 | $6,000,000 | $5,000,000 | $4,285,714 | $3,750,000 | $3,333,333 | $3,000,000 |
| **$2,500,000** | $25,000,000 | $16,666,667 | $12,500,000 | $10,000,000 | $8,333,333 | $7,142,857 | $6,250,000 | $5,555,556 | $5,000,000 |
| **$5,000,000** | $50,000,000 | $33,333,333 | $25,000,000 | $20,000,000 | $16,666,667 | $14,285,714 | $12,500,000 | $11,111,111 | $10,000,000 |
| **$10,000,000** | $100,000,000 | $66,666,667 | $50,000,000 | $40,000,000 | $33,333,333 | $28,571,429 | $25,000,000 | $22,222,222 | $20,000,000 |

**Appendix 12.2:** Firm Valuation as a Function of Investment and Equity

|  |  |  |
| --- | --- | --- |
| **Investment Capital** | **Equity** | **Valuation** |
| $150,000 | 10% | $1,500,000 |
| $150,000 | 15% | $1,000,000 |
| $150,000 | 20% | $750,000 |
| $150,000 | 25% | $600,000 |
| $250,000 | 10% | $2,500,000 |
| $250,000 | 15% | $1,666,667 |
| $250,000 | 20% | $1,250,000 |
| $250,000 | 25% | $1,000,000 |
| $500,000 | 10% | $5,000,000 |
| $500,000 | 15% | $3,333,333 |
| $500,000 | 20% | $2,500,000 |
| $500,000 | 25% | $2,000,000 |

**Appendix 12.3:** Estimated Use of Investment Funds from $150 thousand to $5 million

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Venture Capital** | **Staff** | **Office** | **Labor** | **Travel Budget** | **R and D** | **Legal** | **Rent Utilities** |
| **Level 1** | $150,000 | 1 | No | $1,800 | $10,470 | $13,900 | $10,480 | $1,800 |
| **Level 2** | $250,000 | 1 | No | $193,529 | $12,215 | $20,000 | $16,960 | $5,400 |
| **Level 3** | $500,000 | 2 | Yes | $355,058 | $13,960 | $20,000 | $22,440 | $104,688 |
| **Level 4** | $1,000,000 | 4 | Yes | $811,816 | $27,920 | $30,000 | $17,440 | $101,088 |
| **Level 5** | $1,500,000 | 6 | Yes | $1,274,345 | $43,625 | $45,000 | $17,440 | $101,088 |
| **Level 6** | $2,500,000 | 9 | Yes | $2,157,761 | $68,055 | $45,000 | $42,880 | $155,088 |
| **Level 7** | $5,000,000 | 12 | Yes | $4,431,004 | $90,740 | $120,000 | $82,200 | $227,088 |

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