IP Radiation Detection = Increased Control

IPRD Offers an Innovative Approach to Radiation Security to Meet 21st Century Regulatory, Public Safety and Homeland Security Requirements in the Nuclear Industry

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"The security of radioactive sources is a top priority for the NRC. Along with state agencies and our federal partners, we have taken strong steps to reduce the danger of these materials falling into the wrong hands. Our constant vigilance in this area will help maintain the beneficial uses of these materials as the federal government, states and industry explore potential alternatives."

- NRC Chairman Dale E. Klein

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INTRODUCTION

Radiation security is increasingly becoming focus of radiation safety and control professionals. In late 2005, the Nuclear Regulatory Commission (NRC) issued Order (EA-05-90) for mandatory "Orders of Increased Control" (The Orders) to improve the security of U.S. radiological assets under management by NRC licensees. All licensees had to certify that they were in compliance by June 20, 2006. The regulatory objective of The Orders is to limit unauthorized access to "quantities of concern" of radioactive material and devices that contain material in these quantities to minimize the risk of theft, sabotage or unauthorized use. There is still much discussion within the nuclear industry as to the best means to meet the requirements.

Security professionals, with all their experience protecting facilities, can do much to help speed the transition to a more secure environment for radiation safety and control professionals -- to usher in a new era of radiation security. The security industry has adopted many new Internet Protocol technologies to increase physical security in many facilities over the last several years. The integration of IP Video Surveillance, Voice Over IP (VOIP) and IP Access Control systems with IP Radiation Detection (IPRD), into a unified solution that manages access, monitors, notifies and reports the circumstances around a radiation event at a licensee facility can assist with cost-effective compliance with NRC Orders.

This paper discusses The Orders, their implications for the nuclear industry and how IPRD technologies can assist licensees with their security efforts, while helping each individual licensee stay true to their mission.

TYPES OF FACILITIES DISCUSSED IN THIS PAPER

According to the NRC, "Security orders contain requirements for licensees to implement interim compensatory security measures beyond that currently required by NRC regulations and as conditions of licenses. Some of the requirements formalize a series of security measures that licensees took in response to advisories NRC issued in the aftermath of the September 11 terrorist attacks. Other requirements reflect additional security enhancements that have emerged from NRC's ongoing comprehensive security review."

Radioactive byproduct materials are used in:

- oil and gas, electrical power, medical instrument, construction and food industries
- diagnostic and therapeutic medical equipment and procedures
- government, industrial and university research and development labs

There are approximately 22 thousand facilities in the United States licensed by the NRC and the Agreement States with oversight provided by state regulators in most cases. About 1,700 licensees are covered by the Orders, though all licensees could use IPRD techniques to assist with implementation of the "accountability" aspects of maintaining their license. The NRC grants licenses to these users with rules prohibiting unnecessary radiological exposure to protect workers and the public.

This paper does not discuss IPRD implementation in other key areas, namely:

- Waste facilities, decommissioning sites, border crossings and ports.
- Targets for terrorists, such as public facilities like sports stadiums, skyscrapers, airports, financial districts, malls, etc. all may benefit from the deployment of IPRD.

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- The military is a participant in the nuclear industry, though nuclear weapons are also not a topic included in this paper.

These scenarios each have different drivers and economic variables than the users of radioactive byproduct materials. In each case, first responders in a radiological event would likely benefit from IPRD because they would have much more information available before taking actions called for in response procedures.

PURPOSE OF THE ORDERS

The Orders are designed to reduce risks associated with lost and stolen materials, whether terrorist in nature or through accidental misuse. Licensees must have a documented program to immediately detect unauthorized access to material, assess whether the unauthorized access was an actual or attempted theft, and if the latter, initiate an appropriate response immediately. The measures are also intended to increase the probability of recovery if materials are lost or stolen.

The Orders target holding and transporting specific radioactive isotopes outlined in the International Atomic Energy Agency's (IAEA) Code of Conduct as defined in **Table 1** below. The IAEA developed the Code of Conduct to "help national authorities to ensure that radioactive sources are used within an appropriate framework of radiation safety and security." In developing the list of target isotopes, the IAEA noted: "States should give appropriate attention to radioactive sources considered by them to have the potential to cause unacceptable consequences if employed for malicious purposes…"

MONITORING, SURVEILLANCE, COMMUNICATIONS AND REPORTING REQUIREMENTS

A key component of The Orders is that covered materials shall be monitored constantly. In order to comply, systems must be put in place to facilitate immediate detection, assessment and response. The monitoring requirement may be accomplished using a variety of methods, including but not limited to:

- A monitored intrusion detection system to detect unauthorized access linked to a central monitoring facility
- Electronic devices for intrusion detection to alert nearby facility personnel
- Video surveillance systems, video analytics and/or visual inspection by trained personnel

On December 5, 2007, the NRC issued Order (EA-07-305) requiring individuals be fingerprinted in order to be granted unescorted access to radioactive material in quantities of concern. Licensees had 180 days (June 2, 2008) to implement the requirements. Another potential opportunity for IPRD could be to deploy fingerprint recognition systems as part of an IP Access Control system to insure that only authorized individuals are granted unescorted access.

Licensees must also have procedures in place for responding to events detected during their monitoring. In particular, licensees must, "have the capability for immediate communication to summon appropriate response or assistance," according to the NRC. IPRD communications should provide multiple pathways to provide a failover plan in case of a power or network outage.

These requirements set standards and performance objectives, while it is up to industry to determine the most cost-effective means to achieve the proper levels of security to minimize vulnerability exposure.

Table 1: Radionuclides of Concern

Radionuclide	Quantity of Concern[1] (TBq)	Quantity of Concern[2] (Ci)
Am-241	0.6	16
Am-241/Be	0.6	16
Cf-252	0.2	5.4
Cm-244	0.5	14
Co-60	0.3	8.1
Cs-137	1	27
Gd-153	10	270
Ir-192	0.8	22
Pm-147	400	11,000
Pu-238	0.6	16
Pu-239/Be	0.6	16
Ra-226[5]	0.4	11
Se-75	2	54
Sr-90 (Y-90)	10	270
Tm-170	200	5,400
Yb-169	3	81
Combinations of radioactive materials listed above[3]	See Footnote Below[4]	

Table 1: The Orders apply to licensees who possess radioactive material quantities of concern as identified by Table 1. The footnotes of Table 1 indicate that the aggregate quantity (activity) of collocated sources be calculated for determining whether the IC must be implemented. Source: IAEA Code of Conduct and the NRC

1 The aggregate activity of multiple, collocated sources of the same radionuclide should be included when the total activity equals or exceeds the quantity of concern.

2 The primary values used for compliance with this Order are TBq. The curie (Ci) values are rounded to two significant figures for informational purposes only.

3 Radioactive materials are to be considered aggregated or collocated if breaching a common physical security barrier (e.g., a locked door at the entrance to a storage room) would allow access to the radioactive material or devices containing the radioactive material.

4 If several radionuclides are aggregated, the sum of the ratios of the activity of each source, i of radionuclide, n, A(i,n), to the quantity of concern for radionuclide n, Q(n), listed for that radionuclide equals or exceeds one. [(aggregated source activity for radionuclide A) ÷ (quantity of concern for radionuclide A)] + [(aggregated source activity for radionuclide B) ÷ (quantity of concern for radionuclide B)] + etc..... >1

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THE IPRD INVESTMENT MODEL AND AFFORDABILITY OF COMPLIANCE

Radiation industry professionals agree that increasing security is necessary. They also agree that the funding and security skill sets necessary to implement The Orders in a fast, efficient and effective manner do not currently exist. To date, manual and analog fixes are most often being implemented. As an example, one band aid fix being employed to meet compliance is splitting radiological source material into units below the threshold for storage in multiple locations.

Federal and state funding is not readily available for new systems necessary to implement The Orders. Many radiation control professionals say federal funding is needed if the new security requirements are to be affordable to licensees -- particularly in healthcare and educational research facilities where funding shortages are common. Some corporations and industrial users also face large capital costs to comply because of the scale of their operations.

Customers and vendors of IPRD systems must therefore develop investment models that go beyond initial outlay and maintenance costs. How do we justify the investment in these systems? Can savings be realized from the reduction of time that security, RSO personnel and other employees spend on compliance? What about potential savings from fines for non-compliance."

'Softer' benefits from IPRD may also be realized. For example, in environments that foster the free exchange of ideas such as research centers and educational institutions or in hospitals where wide public access needs to be maintained, well-designed IPRD systems offer the least disturbance to workflow while improving the security of the nuclear materials. NRC licensees managing a wide variety of nuclear materials can aggregate various sensors onto a single network. Organizations with multiple locations could manage radiation security as a single process controlled over the Web. The hard question, as with all qualitative benefits, is how to determine value. Integrating radiological information with other security-based systems can provide better situational awareness to responders as they implement their procedures in the event of an alarm.

Another industry challenge in the U.S. is the pending shortage of radiation safety professionals. The workforce has not grown since the 1979 Three Mile Island accident halted new nuclear power construction projects. Given the demographics of the existing workforce, the industry faces a wave of new retirees. Radiation Safety Officers and other skilled personnel will be forced to do more with less in the future, as the existing workforce begins to retire. In other words, licensees will have to find more efficient ways to implement higher safety and security standards because there will be less human resources available to do things the old way, let alone adding the requirements of The Orders to the equation.

Federal funding would certainly advance industry response to The Orders forward, but there are questions to consider. Some might argue that funding of new security systems masks the true economic burden associated with maintaining a NRC license. But with funding, government regulators have the potential to more quickly tap into a wealth of resultant IPRD data to develop better policies, track materials and improve compliance. IPRD systems can also enable metrics that improve regulations, identify licensee performance trends and improve training throughout the entire compliance chain.

CONCLUSION

Considering all costs and benefits, the investment case for IPRD will likely be strong in many applications.

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Not only are The Orders mandatory, the threat to public safety and physical assets from misuse or abuse is too great to ignore. The nuclear industry is committed do everything possible to protect our radiological assets given available resources.

The Orders are catalyzing a convergence of the radiation control and homeland/physical security industries to create IPRD solutions. IPRD is an idea whose time has come and IPRD monitoring systems are available today.

Just as IP Video Surveillance, Voice Over IP (VOIP) and IP Access Control applications have burgeoned in the markets where security is a high priority, IPRD is poised to be a key security component in the nuclear industry.

While the economics have yet to be fully worked out, the security benefits to NRC licensees and the public will be tremendous, just as other industries have benefited from wide adoption of IP technologies.

While this paper is inspired by the immediate regulatory environment in the United States, radiation detection is a worldwide concern. IP standards are developed through worldwide governance and the IPRD ideas proposed in this paper are applicable everywhere radiation detection is required.

Defentect™ is developing IPRD solutions that tie IP tools such as video, VOIP and Access Control with IP-enabled radiation sensors into application-specific solutions to better meet The Orders compared to the many proprietary analog systems that have been developed to date. To see an example of Defentect's IPRD technology addressing these issues, Click Here for a brief two minute video.

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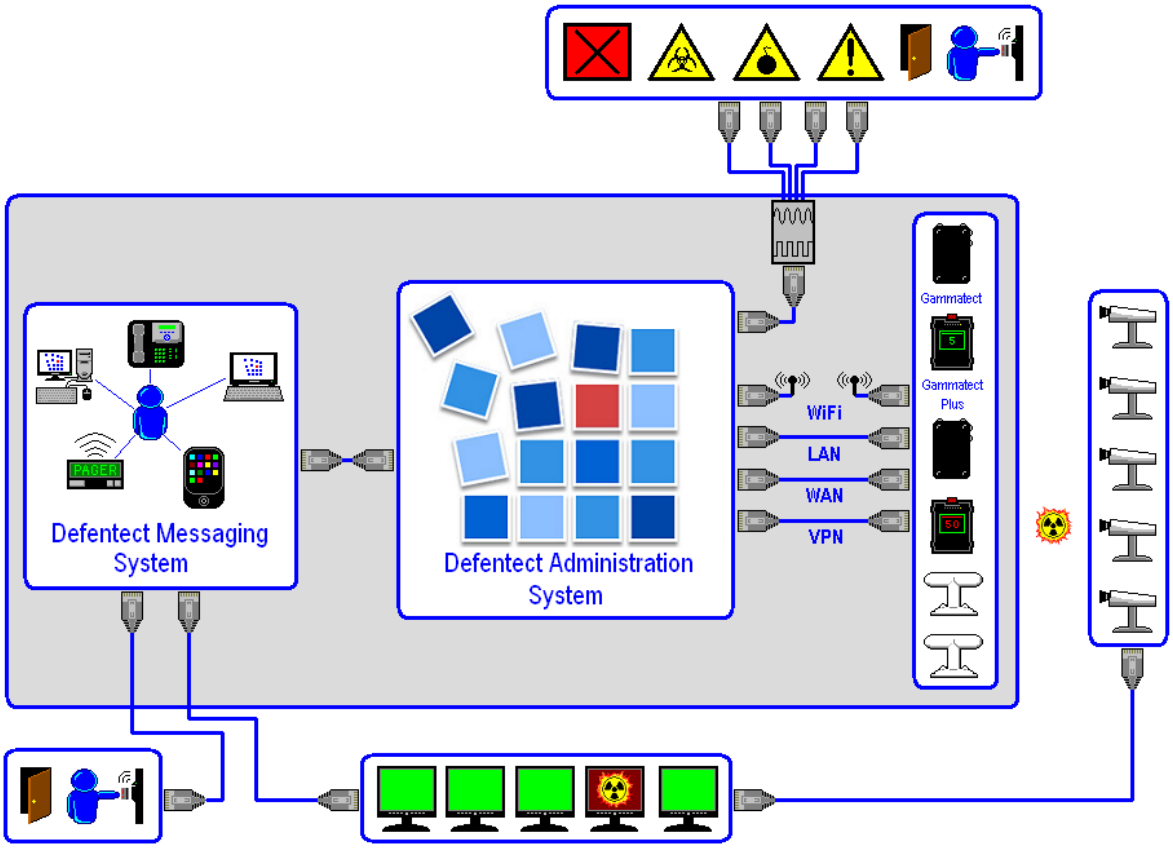
Intelligent Threat Awareness



Defentect™ provides an IP Radiation Detection and response management system for physical and homeland security. The solution helps security personnel more effectively respond to radiation alerts by integrating radiological status information with IP video surveillance and access control systems. Upon alarm, Defentect sends information to responders' cell phones, pagers, video surveillance and other systems critical to implement standard procedures such as those specified under The Orders. While the system is sensor agnostic, Defentect's Gammatect Plus™ sensors can discriminate medical isotopes and background radiation to minimize the impact of innocent positive alarms.

For more information please visit www.defentect.com or call toll-free 1-888-868-8386.

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