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ROSS Skills, Knowledge, and Abilities Training Evaluation: Gaps and Recommendations

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Disclaimer

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1 ROSS Skills, Knowledge, and Abilities Mapping to Training

During radiological and nuclear emergencies, routine decisions and operations for federal, state, local and tribal response agencies become increasingly complex. These actions require radiation experts to safeguard the public and responders. Through the creation of a new position called the Radiological Operations Support Specialist (ROSS), the Departments of Homeland Security (DHS) and Energy (DOE) want to train, equip, and certify radiation experts to integrate with the incident command system (ICS) during response to a radiological and nuclear incident. These ROSS positions will directly support the incident commander, agency decision makers, and elected officials.

The ROSS will be a Technical Specialist under the National Incident Management Systems (NIMS). The Department of Homeland Security's Science and Technology Directorate (DHS S&T) and the National Nuclear Security Administration's (NNSA) Office of Emergency Response are working with Federal Emergency Management Agency (FEMA) to determine the appropriate skills, knowledge, and abilities as well as a complimentary job task analysis of the responsibilities desired for the ROSS to perform. This undertaking will drive the relevant and appropriate training and tools necessary for the ROSS position to succeed.

The Department of Homeland Security, Science and Technology Directorate (DHS S&T) has tasked Lawrence Livermore National Laboratory (LLNL) under IA HSHQPN-14-X-00216 Task 1 "Radiological Operation Support Specialist (ROSS) Position Training Requirements". This task supports the development of ROSS skills, knowledge, and abilities (SKAs), the identification of potentially relevant training, the cross-mapping of the training to the SKAs, and the identification to not only the gaps in the training related to the SKAs, but also their respective level of training knowledge currently versus desired. This document summarizes the results of the cross-mapping effort and the gaps identified during the mapping process. The associated Excel Spreadsheet, LLNL-MI-677474, contains the details of the cross-mapping.

LLNL surveyed the available radiological and ICS related training across a range of agencies including the DOE with Emergency Operations Training Academy (EOTA) and NNSA courses, DHS with FEMA and Counter Terrorism Operations Support (CTOS) training, and the Nuclear Regulatory Commission (NRC). LLNL cross-mapped the training courses to the ROSS SKAs to determine which courses addressed the SKAs and at what level of knowledge. Gaps were identified in which the level of proficiency of the SKAs were not met at all or were only partially met. Course materials were provided by the agency or the actual online course was taken to determine the detailed components of the course and how they relate to the ROSS SKAs.

This document describes the development of the ROSS SKAs, the cross-mapping of the SKAs to the available training, identifies gaps in the SKA and training, and provides recommendations to address those gaps.

2 Development of ROSS Skills, Knowledge, and Abilities

The concept of the ROSS was conceived through the efforts of the FEMA Chemical Biological Radiological Nuclear Explosive (CBRNE) Office Response Working Group (RWG). The Response Working Group was formed to bridge the gaps identified in The DHS Strategy for Improving the Response and Recovery from an Improvised Nuclear Detonation (IND) Attack (The Strategy). The group consisted of approximately 70% state and local responders and planners, the remainder being federal governmental employees. They identified the desired ROSS function and job description, from which the ROSS type definitions (see Table 1 below), job task analysis (Appendix A), and list of required skills, knowledge, and abilities (Appendix B) was developed.

Table 1. ROSS Type definitions

TYPE 1	TYPE 2	TYPE 3
In addition to the Type 2 ROSS, the Type 1 ROSS also: *1.* Synthesizes available radiological and situational information to make recommendations required by the executive levels of government making decisions for the broadest populations. *2.* Identify medical response issues by identifying what emergency medical personnel are confronting and projection what may be required to control and manage radiation exposures. *3.* In consultation with State and Local agencies, makes recommendations for the activation and integration of key federal radiological response assets and capabilities from across the USG. *4.* Coordinates the radiological activities and technical data with other ROSS team members and federal response assets across the entire incident. *5.* Integrates into a state's emergency operations and coordinates with radiological control authority. *6.* Supports radiological response preparedness activities and exercises at the state and local level.	**In addition to the Type 3 ROSS, The Type 2 also:** *1.* Performs exposure estimates for a variety of internal and external exposure scenarios *2.* Understands key state and federal radiological response capabilities / assets, reporting structures, and how to support their activation and integration into a response. *3.* Communicates complex radiological issues to large groups and/or senior executives and support public message development. *4.* Assist in the development of EOC level objectives for the implementation of protective actions and emergency worker protection on a state & local level *5.* Reviews plans to ensure emergency exposures are kept As low As Reasonably Achievable (ALARA). *6.* Works closely with command staff *7.* Able to resolve conflicting measurement / modeling data.	Given the wide range of responsibilities, the ROSS needs several specialized skills in addition to being a radiation protection expert. The ROSS must clearly understand the technical aspects of plume modeling, radiological data assessment, and possess a detailed knowledge of the hazards and risks associated with a radiological/nuclear incident. A firm understanding of available technical tools (e.g. RadResponder and CMWeb) is also required, as is the ability to gather information from these sources and interpret it over time. The ROSS must also understand the nuances of NIMS and its application to various centers of activity, including the Incident Command System in the field. Likewise, the ROSS must know who, at each level of the response, needs information and facilitate those people receiving it in a timely manner. Finally, the ROSS requires excellent communication and interpersonal skills since the specialist will interface with Incident Commanders and response personnel on the scene **The Type 3 ROSS:** *1)* Provides radiological incident assessment and resource information through: *a)* Interpreting Model and Measurement results and data products *b)* Proficient use of RadResponder to collect and share data *c)* Awareness of state radiation control program and key federal radiological response assets *d)* Exchange of technical information with other ROSS members in the response and advisory organizations and protection guidance is being properly communicated and understood *e)* Identification when ROSS type 2 or 1 is warranted for the situation *f)* Supporting the development of command post level objectives for the implementation of protective actions and emergency worker protection on a unit-by-unit level *2)* Guides radiological aspects of response during the event by their. *a)* Working knowledge of radiological protection guidance and best practices, including how Protective Action Guides (PAG) and Protective Action Recommendations (PAR) are generated and used. *b)* Ability to obtain updated/additional radiological advice and recommendations from appropriate advisory organizations. *3)* Communicates radiological issues to a non-technical audience and provides just in time training for first responders for Rad responder, monitoring devices, and safety protocols. 4) Integrates into the ICS structure.

Based on the description of the ROSS position as shown in Table 1, several categories of ROSS SKAs were developed by the group and approved by a select group of subject matter experts (SME). These are the SKAs used for the cross-mapping of currently available training to the SKAs. A summary of the SKA development is described in the following section. In total, 497 SKAs were identified across 7 categories for the three

ROSS types described above – 178 for Type 1, 168 for Type 2, and 151 for Type 3 as shown in Table 2.

Table 2. Number of SKA categories for each specific ROSS Type.

SKA Categories	Type 1 178	Type 2 168	Type 3 151	*Total SKAs* *497*
1. General Health Physics				
a. Measurements and Instrumentation	48	47	47	*142*
b. Standards and Requirements	20	18	18	*56*
c. Hazards Analysis and Controls	23	19	15	*57*
d. Operations and Procedures	30	30	20	*80*
e. Fundamentals and Education	20	20	17	*57*
2. Radiological Response Knowledge & Tools	35	32	32	*99*
3. Addendum: ICS/NIMS	2	2	2	*6*

Radiation Protection

One of the most important SKAs required for the ROSS position is an in depth understanding of radiation protection issues. It is expected that ROSS candidates would likely come from Health Physics / Radiation Protection programs within the state or local community and have a strong radiation protection background and baseline knowledge. Therefore, an evaluation of what a typical ROSS candidate may bring with them in terms of SKAs in the area of radiation protection was used as a basis for developing the radiation protection SKAs. Based on the American Board of Health Physics (ABHP) determination of what a typical health physicist does to perform his/her job, five main categories were selected:

1. Measurements and Instrumentation
2. Standards and Requirements
3. Hazards Analysis and Controls
4. Operations and Procedures
5. Fundamentals and Education

Each of the five categories was further subdivided into sub-categories to account for the subjects covered in each category. A total of 392 Health Physics SKAs (141 for Type 1, 134 for Type 2, and 117 for Type 3) were identified using the ABHP information and developed as SKAs for the ROSS role.

Radiological Response

Beyond the basic understanding of radiological issues, the ROSS needs to understand the federal response structure, tools, and assets that can be used during a response. These SKAs are generally not addressed in formal health physics education programs and represent the greatest need for specialized training. A total of 99 SKAs (35 for Type 1, 32 for Type 2, and 32 for Type 3) in this category were developed for the ROSS role.

NIMS/ICS

Understanding of non-radiological response doctrine is required to integrate into the response. Fortunately, the FEMA response working group provided clear guidance on the types of classes required for the ROSS to understand and integrate into ICS. These classes are well defined and widely available, and specific SKAs were not developed. However, during the cross-mapping effort, it was determined that specific SKAs should be defined for the ROSS and will be discussed in Section 7.

General Skills and Response Capabilities

There are many physical skills and abilities required for the ROSS position; these include good communication skills and the ability to rapidly deploy and work long hours in austere conditions, among others. Although coursework can help develop these abilities (e.g., a course in public speaking), they are generally skills and abilities that are established through personality and practice. Specific SKAs for this category were not developed.

3 Evaluated Courses

A total of 53 courses were originally identified for evaluation and cross-mapping to the 497 ROSS SKAs and are listed in Table 3. The final list of courses was reviewed and agreed on by a group of SMEs. When possible, detailed course materials were provided by the agencies or the actual course was taken online. Several agencies did not provide the course material for this evaluation, and these courses were not included in the cross-mapping analysis as noted in Table 3.

Table 3. List of courses mapped to ROSS SKAs

CTOS: AWR-140	DOE: TEPP Day 1	FEMA : IS-3	FEMA: IS-836
CTOS: AWR-140-W[2]	DOE: TEPP Day 2	FEMA: ICS-100	FEMA: IS-922
CTOS: AWR-224-W[4]	EOTA: EMP 170DW		FEMA: MGT-903
CTOS: PER-240	EOTA: EPI 100DW	FEMA: ICS-300	FEMA: PER-905[3]
CTOS: PER-241	EOTA: EPI 340DW[2]	FEMA: ICS-400	FEMA: RERO/PER-904[3]
CTOS: PER-243[4]	EOTA: ERO 102DW	FEMA: IS-2900[1]	NNSA : LN-100
CTOS: Per-243-1[4]	EOTA: ERO 103DW	FEMA: IS-301	NNSA: LN-200
CTOS: PER-245[4]	EOTA: ERO 220D[2]	FEMA: IS-302	NRC: H-107
CTOS: Per-246[4]	EOTA: NARAC101	FEMA: IS-303	NRC: H-203[3]
CTOS: PER-247[4]	EOTA: PAR101DW	FEMA: IS-700.A	OSHA: 29 CFR 1910.1096[3]
CTOS: PER-297-W[4]	EOTA: RAP112DW[5]	FEMA: IS-701.A	ORISE: Health Physics in Radiation[3]
CTOS: PER-300[4]	EOTA: RAP130DW	FEMA: IS-775	ORISE: Incident Command System (ICS) Training[3]
CTOS: PER-300-W[4]	EOTA: RAP160DW[1]	FEMA: IS-800.B	
CTOS: PER-307-W	EOTA: RAP170DW	FEMA: IS-820[1]	

[1]Training did not map to SKA Table
[2]Training was a duplicate to other reviewed training
[3]Vendor/Point of Contact did not respond to requests to provide course training material
[4]Course was identified as not needed for review by SMEs
[5]Course no longer exists

It was discovered during the cross-mapping process that many of the courses identified for evaluation did not map to any of the SKAs or could not be reviewed due to reasons identified in Table 3. A total of 30 courses did have content that mapped to the SKAs and are listed in Table 4. These are the courses that were cross-mapped to the SKAs.

Table 4. List of courses with content that mapped to ROSS SKAs

CTOS: AWR-140	DOE: TEPP Day 1	FEMA : IS-3	FEMA: IS-836
CTOS: PER-240	DOE: TEPP Day 2	FEMA: ICS-100	FEMA: IS-922
CTOS: PER-241	EOTA: EMP 170DW	FEMA: ICS-300	NNSA : LN-100
CTOS: PER-307-W	EOTA: EPI 100DW	FEMA: ICS-400	NNSA: LN-200
	EOTA: ERO 102DW	FEMA: IS-301	NRC: H-107
	EOTA: ERO 103DW	FEMA: IS-302	
	EOTA: NARAC101	FEMA: IS-303	
	EOTA: PAR101DW	FEMA: IS-700.A	
	EOTA: RAP130DW	FEMA: IS-701.A	
	EOTA: RAP170DW	FEMA: IS-775	
		FEMA: IS-800.B	

4 Cross-mapping by Course

The 497 ROSS SKAs were mapped against the 30 identified courses to determine which courses addressed which SKAs. This cross-mapping is shown in Spreadsheet LLNL-MI-677474.

Table 5 shows a summary of the cross-mapping of the courses to the specific SKA categories. A significant number of the courses covered only a few of the SKAs. However, there were a couple of courses that stood out as covering a larger number of the SKAs. CTOS: Per-241 was a standout with 40 SKAs covered. While this is the largest number of SKAs covered by a single course, it is still quite small compared to the total 497 SKAs.

Table 5. SKAs mapped to specific courses

	CTOS: AWR-140	CTOS: PER-240	CTOS: PER-241	CTOS: PER-307-W	DOE: TEPP Day 1	DOE: TEPP Day 2	EOTA: EMP 170DW	EOTA: EPI 100DW	EOTA: ERO 102DW	EOTA: ERO 103DW	EOTA: NARAC101	EOTA: PAR101DW	EOTA: RAP130DW	EOTA: RAP170DW	FEMA : IS-3	FEMA: ICS-100	FEMA: ICS-300	FEMA: ICS-400	FEMA: IS-301	FEMA: IS-302	FEMA: IS-303	FEMA: IS-700.A	FEMA: IS-701.A	FEMA: IS-775	FEMA: IS-800.B	FEMA: IS-836	FEMA: IS-922	NNSA : LN-100	NNSA: LN-200	NRC: H-107	Total
Total Count of SKAs mapped to course	13	22	40	4	23	9	9	2	1	1	3	1	4	1	8	1	2	1	25	17	18	1	1	2	1	1	1	11	6	8	30
General Health Physics Measurements and Instrumentation	3	8	10	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	7	10	6	0	0	0	0	0	0	0	0	0	7
Standards and Requirements	3	2	6	0	5	3	0	0	0	0	0	0	0	0	1	0	0	0	5	2	4	0	0	0	0	1	0	0	0	0	10
Hazards Analysis and Controls	0	3	4	0	1	2	1	0	0	0	0	0	0	0	1	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	9
Operations and Procedures	1	3	5	1	3	1	8	0	1	0	0	1	0	0	1	0	0	0	5	2	2	0	0	0	1	0	0	0	0	6	15
Fundamentals and Education	4	4	11	1	4	1	0	0	0	0	0	0	0	0	3	0	0	0	4	1	4	0	0	0	0	0	0	0	0	1	11
Radiological Response Knowledge & Tools	2	2	4	2	0	0	0	0	0	1	3	0	4	1	2	0	0	0	3	0	1	0	0	0	0	0	1	11	6	1	15
Addendum: ICS/NIMS	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	1	2	1	0	0	0	1	1	2	0	0	0	0	0	0	8

5 Cross-mapping by Competency

Each of the ROSS SKAs have competency levels (Advanced, Intermediate, Novice, and Awareness) identified for each of the ROSS level positions (ROSS Type 1, ROSS Type 2, and ROSS Type 3) and are shown in Appendix B. The definitions of the competency levels are shown in Table 6. In addition to cross-mapping to the ROSS SKAs, the 30 training courses were also evaluated to each required competency level. The competency level achieved by the course was determined and compared to the required SKA competency level for each ROSS Type. This detailed mapping by competency is located in Spreadsheet LLNL-MI-677474.

Table 6. Competency level definitions

Competency Level	Definition
Awareness	Have a common knowledge or an understanding of basic techniques and concepts
Novice	Understand and can discuss terminology, concepts, principles, and issues related to this competency
Intermediate	Able to successfully complete tasks in this competency as requested. Help from an expert may be required from time to time, but you can usually perform the skill independently
Advanced	Perform the actions associated with this skill without assistance. You are certainly recognized within your immediate organization as "a person to ask"

5.1 Evaluation of Gaps by Competency

The cross-mapping developed by LLNL and presented in this document is done without consideration to any prior qualifications. In other words, the mapping was treated as though a candidate had no prior experience or certifications. However, it is reasonable to assume that a typical ROSS candidate will have prior training, education, and certifications that will already meet a number of the required competency levels. It is also reasonable to assume that some subset of SKAs will need to be filled by additional training. An example of existing gaps for a ROSS candidate with prior qualifications is presented in Section 6.

5.2 Gap Identification of Courses Mapped to SKA Competency Levels

The mapped competency level was compared to the required SKA competency level for each ROSS Type and given an evaluation of “Exceeds, Match, Partial, or None” as defined in Table 7.

Table 7. Mapped evaluation level definitions

Mapped Evaluation Level	Definition
Exceeds	Mapped course competency exceeds the level required for SKA
Match	Mapped course competency matches the level required for SKA
Partial	Mapped course competency is less than the level required for SKA
None	The evaluated course did not map to the SKA

The total number of SKA categories that mapped to a training course at an identified competency level, regardless of ROSS Type is shown in Table 8. The mapping shows that the majority of SKAs were not covered by any of the evaluated training when assuming the ROSS candidate has no prior experience or training related to the SKAs. Within each SKA category, the percentage of SKAs that were not mapped to any training is shown in Table 8 in the last column (% of total, None) and ranged from 44% to 74% for each category. For all of the SKAs, 78% only partially met (23%) or did not map at all (55%) to any of the training. Only 22% of SKA categories either matched or exceeded the competency level.

The numbers in Table 8 clearly indicate that there are a significant number of gaps in the SKAs within each SKA category, assuming the ROSS candidate has no prior education or certifications. This presents a challenge to identify and develop gap filling training for the ROSS position. However, the number of identified gaps decreases considerably if we assume a more realistic ROSS candidate with related experience and training. This scenario is presented in Section 6.

Table 8. Number of SKA categories that map to specific competency levels.

SKA Categories	Exceeds 30	Match 81	Partial 115	None 271	Total 497	% of total; Exceeds 6	% of total; Match 16	%of total Partial 23	% of total, None 55
1. General Health Physics									
a. Measurements and Instrumentation	2	15	41	84	142	1	11	29	59
b. Standards and Requirements	0	13	20	23	56	0	23	36	41
c. Hazards Analysis and Controls	1	7	7	42	57	2	12	12	74
d. Operations and Procedures	11	12	9	48	80	14	15	11	60
e. Fundamentals and Education	1	10	21	25	57	2	18	37	44
2. Radiological Response Knowledge & Tools	9	24	17	49	99	9	24	17	49
3. Addendum: ICS/NIMS	6	0	0	0	6	100	0	0	0

6 Assessment of Gaps

While there are a significant number of gaps in both the quantity and competency level of SKAs covered by the evaluated training courses, it is realistic to assume that for each ROSS Type, a candidate will likely have a significant amount of education, training and certifications. LLNL recommends that for each ROSS Type a set of criteria should be defined in order to qualify as a candidate for each of the ROSS types. If criteria are selected wisely, many of the SKAs should be met by those pre-existing qualifications. Table 9 shows an example of the potential types of candidates and the competency levels met by the education/certification for the SKA categories. In these examples, the competency levels met are the same for all the SKA categories. This may not be the case for all education, training, and certifications.

Table 9. Examples of prior education and certification levels and SKA competency levels met

Education/Certification	Competency Level Met
American Board of Health Physics (ABHP) exam	Intermediate in all categories
Certified Health Physicist (CHP)	Advanced in all categories
PhD Radiological Health Physics	Advanced in all categories
National Registry of Radiation Protection Technologists (NRRPT) Certification	Novice in all categories

6.1 SKA cross-mapping for American Board of Health Physics

A ROSS candidate that has passed the American Board of Health Physics (ABHP) exam is assumed to have an "Intermediate" competency level for all SKAs. Table 10 shows the cross-mapping of the SKAs to the ABHP certification level for all three ROSS Types combined. A candidate who has passed the ABHP exam will only have a few training gaps to fill, with 99% of the SKAs competency levels met or exceeded. There are no SKA categories that are not met at all.

This cross-mapping indicates that there would be only a few SKAs that would need gap filling training in the "Operations and Procedures", "Fundamentals and Education", and "Radiological Response Knowledge & Tools". This demonstrates a much more manageable – and more realistic - approach than shown in Section 5.2.

Table 10. ABHP SKA competency level cross-mapping to training for all ROSS Types

SKA Categories	Exceeds 363	Match 129	Partial 5	None 0	Total 497	% of total; Exceeds 73	% of total; Match 26	%of total Partial 1	% of total, None 0
1. General Health Physics									
a. Measurements and Instrumentation	111	31	0	0	142	78	22	0	0
b. Standards and Requirements	38	18	0	0	56	68	32	0	0
c. Hazards Analysis and Controls	54	3	0	0	57	95	5	0	0
d. Operations and Procedures	60	17	3	0	80	75	21	4	0
e. Fundamentals and Education	29	27	1	0	57	51	47	2	0
2. Radiological Response Knowledge & Tools	65	33	1	0	99	66	33	1	0
3. Addendum: ICS/NIMS	6	0	0	0	6	100	0	0	0

6.2 SKA cross-mapping for National Registry of Radiation Protection Technologists (NRRPT)

6.2.1 NRRPT mapping for ROSS Type 1, ROSS Type 2, and ROSS Type 3

A ROSS candidate with the National Registry of Radiation Protection Technologists (NRRPT) certification will have a SKA competency level of Novice in all SKA categories. The cross-mapping for all three ROSS Types (1, 2, and 3) shown in Table 11 demonstrates that all of the SKAs are at least partially met and in most cases are actually matched or exceeded.

Table 11. NRRPT SKA competency level cross-mapping to training for all ROSS Types

SKA Categories	Exceeds 168	Match 193	Partial 136	None 0	Total 497	% of total; Exceeds 34	% of total; Match 39	%of total Partial 27	% of total, None 0
1. General Health Physics									
a. Measurements and Instrumentation	54	57	31	0	142	38	40	22	0
b. Standards and Requirements	20	18	18	0	56	36	32	32	0
c. Hazards Analysis and Controls	26	27	4	0	57	46	47	7	0
d. Operations and Procedures	21	39	20	0	80	26	49	25	0
e. Fundamentals and Education	7	21	29	0	57	12	37	51	0
2. Radiological Response Knowledge & Tools	34	31	34	0	99	34	31	34	0
3. Addendum: ICS/NIMS	6	0	0	0	6	100	0	0	0

6.2.2 NRRPT mapping for ROSS Type 3 only

To better isolate the training gap for this case, reviewing the SKA match at the ROSS Type 3 level will provide better information since an NRRPT certification would be appropriate for a ROSS Type 3. Table 12 shows the cross-mapping specifically for a ROSS Type 3 with an NRRPT certification. This shows that the vast majority of SKA requirements are met by the NRRPT certification with the largest exceptions for “Operations and Procedures” and “Fundamentals of Education” where 20% and 18% of the SKAs in those categories meet only the “Partial” level.

Table 12. NRRPT SKA competency level cross-mapping for training for ROSS Type 3 only

SKA Categories	Exceeds 99	Match 39	Partial 13	None 0	Total 151	% of total; Exceeds 66	% of total; Match 26	%of total Partial 9	% of total, None 0
1.General Health Physics									
a. Measurements and Instrumentation	29	15	3	0	47	62	32	6	0
b. Standards and Requirements	18	0	0	0	18	100	0	0	0
c. Hazards Analysis and Controls	12	3	0	0	15	80	20	0	0
d. Operations and Procedures	9	7	4	0	20	45	35	20	0
e. Fundamentals and Education	4	10	3	0	17	24	59	18	0
2. Radiological Response Knowledge & Tools	25	4	3	0	32	78	13	9	0
3. Addendum: ICS/NIMS	2	0	0	0	2	100	0	0	0

Table 13 shows the specific SKAs that are only met at the "Partial" level for the NRRPT certified ROSS Type 3 candidate. It is important to note that none of the evaluated courses would fill these gaps since they only met the "Novice" level and not the "Intermediate" level required by the SKA competency level required for the ROSS Type 3. Gap filling training would only need to cover a few categories in "Measurements and Instrumentation", "Operations and Procedures", "Fundamentals and Education", and "Radiological Response Knowledge & Tools". By cross-mapping based on candidate education and certification for a specific ROSS Type a much clearer picture of the SKA gaps and gap filling training is identified.

Table 13. Specific gap SKA categories for NRRPT for ROSS Type 3 only

SKA Categories	SKA Gap at "Partial" Level
Measurements and Instrumentation	• Measuring removable and fixed contamination • Frisking and scanning techniques
Operations and Procedures	• Establish dose controls for emergency workers • Specify procedures for handling of radioactively contaminated persons, including decontamination and decorporation • Communication - Explain the risks and significance of radiation exposure
Fundamentals and Education	• Known effects of major radiological incidents and accidents (e.g., criticality accidents, Three Mile Island, Chernobyl) • Fundamental characteristics include basics such as the mode of decay, principal type(s) of radiation emitted, energies of radiation emitted, and half-life. • The candidate should be familiar with fundamental characteristics of those radionuclides commonly encountered in the radiation protection field including: H-3, Sr-90, Tc-99m, F-18, I-125, I-131, P-32, Cs-137, Ra-226, Co-60, Am-241, Radon, Uranium, and Plutonium
Radiological Response Knowledge & Tools	• Emergency Monitoring Strategies (e.g., 10 point Strategy) • RadResponder • CRCPD response recommendations

7 Additional ROSS SKAs

During the cross-mapping process, LLNL identified that an additional set of SKAs were needed for the ROSS position. The understanding and integration of the ROSS into the Incident Command System (ICS) and National Incident Management System (NIMS) will be crucial for the ROSS. Detailed SKAs within this category need to be identified and competency levels assigned for each ROSS Type. An additional SKA category was added to the Spreadsheet LLNL-MI-677474 as “Addendum: ICS/NIMS” with the following SKAs that were cross-mapped in this task:

1. Understanding and integration of ROSS into ICS
2. Understanding and integration of ROSS into NIMS

These additional categories should be evaluated for inclusion and more specific SKAs and competency levels be developed as appropriate for the ROSS position.

8 Summary and Recommendations

The LLNL cross-mapping of the ROSS SKAs was performed by comparing the available training to the competency levels for each SKA. This method identified a significant number of gaps where the available training reviewed only partially covered competency levels, and in most cases, the training did not cover any of the SKAs. In review of these results, it became apparent that this method would only apply where a ROSS candidate had no relevant prior education or certifications. The number of gaps and resultant need for development of additional gap filling training was unrealistic; therefore, LLNL did a preliminary assessment of cross-mapping possible ROSS candidate certifications to the ROSS SKAs and the SKA competency levels. This resulted in a much more reasonable number of identified gaps and more realistic additional gap filling training requirements.

Since ROSS candidates will already have prior certifications and level of education, LLNL recommends that the range of education and certifications for each ROSS Type candidates be identified as well as the level of competency they would meet for each SKA. As an example, a ROSS candidate with a certification as a Certified Health Physicist (CHP) could be at the “advanced” level for all the SKAs, and therefore, a CHP would not require any additional training for any of the three ROSS Types. Defining existing certifications and education would better clarify additional training needed by the ROSS candidates.

Once a range of education and certification levels has been identified and assigned competency levels for the SKAs, the gaps in training for each of the cases can be readily discerned based on the cross-mapping shown in Spreadsheet LLNL-MI-677474. This can be done by simple correlation of the different ROSS pre-qualification competency levels to the already mapped training from this task effort.

LLNL recommends that the additional identified SKAs be reviewed and added to the ROSS SKA list. LLNL also recommends that a range of pre-qualification education and certification levels be identified for the ROSS candidates and mapped back to the cross-mapped training to identify specific and tailored training gaps. This will result in a realistic and manageable level of gaps and development of gap filling training.

Acronyms and Abbreviations

ABHP	American Board of Health Physics
AMS	Aerial Measuring System
ARG	Accident Response Group
CBRNE	Chemical Biological Radiological Nuclear Explosive
CHP	Certified Health Physicist
CTOS	Counter Terrorism Operations Support
DHS	Department of Homeland Security
DHS S&T	Department of Homeland Security's Science and Technology Directorate
IND	Improvised Nuclear Device
EOTA	Emergency Operations Training Academy
FEMA	Federal Emergency Management Agency
FRMAC	Federal Radiological Monitoring and Assessment Center
ICS	Incident Command System
LLNL	Lawrence Livermore National Laboratory
NEST	Nuclear Emergency Support Team
NIMS	National Incident Management Systems
NIMS	National Incident Management System
NRC	Nuclear Regulatory Commission
NRRPT	National Registry of Radiation Protection Technologists
OUO	Official Use Only
RAMS	Radiological Assessment and Monitoring System
REAC/TS	Radiation Emergency Assistance Center/Training Site
ROSS	Radiological Operations Support Specialist
RWG	Response Working Group
SKAs	Skills, Knowledge, and Abilities
SME	Subject Matter Expert

Appendix A: Job Task Analysis

A ROSS Job task analysis was performed to evaluate the possible skills, knowledge, and abilities required.

ROSS Cadre

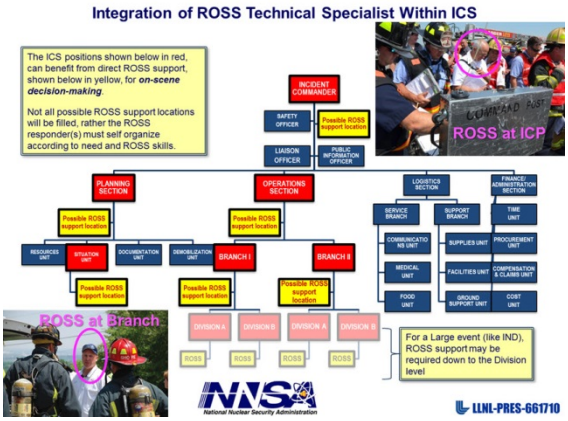
During a major radiological or nuclear event, it would be expected that there would be more than one ROSS and they would occupy multiple locations within an incident. They would communicate internally to harmonize guidance and situational assessment through electronic communication tools such as RadResponder and CMWeb.

NIMS Typing vs. Work Location

The ROSS Type (I, II, or III) does not directly correlate to work location. In general, however, it is expected that a Type I ROSS would have more strategic and federal resource integration skills that would be practical at the EOC. **Since the ROSS can support several different ICS structure locations, a Job Task Analysis was performed for three separate locations within the ICS structure. Please review each functional area and provide feedback**:

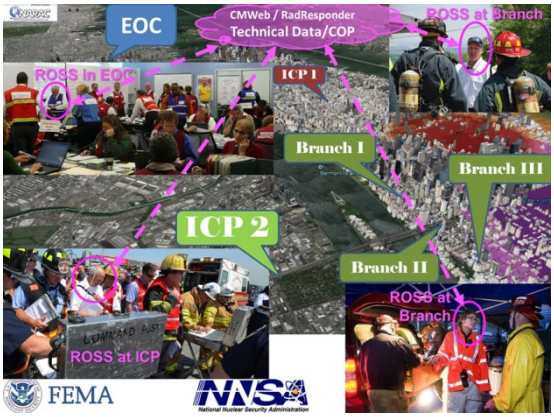
Emergency Operations Center (EOC)

The physical location at which the coordination of information and resources to support incident management (on-scene operations) activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction. EOCs may be organized by major functional disciplines (e.g., fire, law enforcement, medical services), by jurisdiction (e.g., Federal, State, regional, tribal, city, county), or by some combination thereof.



Incident Command Post (ICP)

The ICP signifies the location of the tactical-level, on-scene incident command organization. It typically comprises the Incident Command and the Command and General Staffs, but may include other designated incident personnel from Federal, State, tribal, and local departments and agencies, as well as NGOs and the private sector. Typically, the ICP is located at or in the immediate vicinity of the incident site and is the location for the conduct of direct, on-scene control of tactical operations. Incident planning is conducted at the ICP; an incident communications center also would normally be established at this location. The ICP may be co-located with the Incident Base, if the communications requirements can be met.



Branch / Division

The organizational level having responsibility for operations within a defined geographic area. Divisions are established when the number of resources exceeds the manageable span of control of the Section Chief. This is most often the forward most area, often near the hotline.

ROSS Tasks for Various ICS Roles	EOC Support	ICP Support	Branch /Division
Knowledge and Access to Supporting Resources	Reports to: EOC manager	Incident Commander	Branch Director
Call DOE to request information or data products, policy or authority questions, and questions about DOE assets, timelines, and capabilities	X	X	
Call CM home team for technical questions	X	X	
Call Advisory team for questions and advice relating to food, health, and environment	X	X	
Describe DOE assets (RAP, AMS, FRMAC, NARAC, etc..) mission, response timelines, footprints, and capabilities	X	X	X
Describe DoD/NG assets (CST, CERFP, AFRAT, etc..) mission, response timelines, footprints, and capabilities	X	X	X
Identify Purpose of IMAAC	X	X	X
Identify purpose of RAMS	X	X	X
Identify purpose of CM web / NARACWeb	X	X	X
Identify purpose of TurboFRMAC	X		
Access RAMS account and download/upload files	X	X	X
Access CM Web account and download/upload files	X	X	X
Access Turbo FRMAC account and download/upload files	X		
Access RADResponder account and download/upload files	X	X	X
Explain the purpose and function of RASCAL	X		
Explain the purpose and function of HPAC	X		X
Explain the purpose and function of RESRAD	X		
Explain where to get these tools and/or the agency that has them	X		

ROSS integration into NIMS and ICS structure	EOC Support	ICP Support	Branch /Division
Identify how to execute work within ICS structure	X	X	X
Identify how FRMAC fits in with NIMS and ICS and the overall structure	X	X	X
Communicate "2 minute" description of ROSS role to IC & EOC Manager	X	X	X
Using field data and CM products; identify protective measures, and stay times, and the safety envelope.	X	X	X
Identify potential over-exposure concerns and recommendations to IC for responder follow up.	X	X	X
Identify how to plug in additional assets consistent with FRMAC and NIMS/ICS	X	X	

Support Field Operations	EOC Support	ICP Support	Branch /Division
Support the collection and “upload” of actionable, qualified data. Instruct field teams on rad-responder.			X
Identify the appropriate radiological instruments and methods for the mission.	X	X	X
Provide Just-in-Time training for responders operating in a radiological environment. Include risk communication / perspective so the radiological risk is put into context of the overall hazards.		X	X
Provide interpretation of confounding instrument readings/results.	X	X	X
Identify appropriate alarm set points / dose alerts.	X	X	X
Identify current guidelines on PPE, dose, population monitoring, and zone definition and controls. For a large or unique threat incident, scale / adjust guidelines to balance responder risk and response benefit.	X	X	X
Provide radiological perspective for development of Incident Action Plan		X	
Help IC adjust responder dose guidelines "on the fly" for rescue operations involving large doses and vulnerable populations		X	X

Deconflict & identify radiological technical deficiencies	EOC Support	ICP Support	Branch /Division
Distinguish relevant information for FRMAC from other non-mission essential information	X		
Identify when an unmet need for a data product or radiological expert support is present	X	X	X
Evaluate quality of radiological data from a variety of sources	X		

Support Situational Assessment / Awareness	EOC Support	ICP Support	Branch /Division
Identify the right meetings / mechanisms to Relay important information to other responders, incident managers, agencies, and stakeholders	X	X	X
Record and relay any requests to IMAAC/NARAC/FRMAC from other entities	X	X	
Explain the purposes and uses of a HSIN account	X	X	
Demonstrate awareness of different Communities of Interest (COIs) on HSIN	X	X	
Prepare the radiological component of the Situation Report (SitRep)	X	X	
Recognize that IMAAC/NARAC/FRMAC makes maps, can provide model runs, briefing products, and technical reports	X	X	X
Identify where to get map products and how to distribute them	X	X	X
Recognize qualitatively what GIS can do	X		
Describe the relevant information on the map	X		
Identify what can be added (agricultural, special population, local datasets, etc.) to a map	X	X	
Describe the information that each of the IMAAC/NARAC/FRMAC products is communicating in a meaningful way to the specific customer	X	X	X

Support Situational Assessment / Awareness	EOC Support	ICP Support	Branch /Division
Recognize the common questions that the IMAAC/NARAC/FRMAC products are intended to answer	X	X	X
Identify standard IMAAC/NARAC/FRMAC products	X	X	X
Identify standard layout for IMAAC/NARAC/FRMAC products	X	X	X
Recognize when a product is not the best suited option and recommend a more appropriate product	X	X	X
Log on and get data to person who needs it using various tools (spreadsheets, Rad Responder, fax, etc.)	X	X	X
Explain Basic Assumptions Built in IMAAC/NARAC/FRMAC products	X	X	X
Respond to difficult questions or requests that would result in non-standard interpretation and use of products	X		
Interpret the NARAC products and the scientific understanding behind it	X	X	X
Interpret the AMS products and the scientific understanding behind it	X		
Interpret the Assessment products and scientific understanding behind it	X		

Integrate into State's Radiation Control Program	EOC Support	ICP Support	Branch /Division
Explain the implications of radiological response in an NRC Agreement State and Non-Agreement State	X		
Define the role and response recommendations of the CRCPD	X		

Demonstrate a basic understanding of PAGs vs. PARs	EOC Support	ICP Support	Branch /Division
Explain the differences between technical guidance vs. making recommendations	X	X	X
Recognize the scientific decision basis of public protection	X	X	X
Recognize that different decision levels apply to different pathways	X	X	X
Put PAGs and PARs into context with overall levels of risk to workers and the public	X	X	X
Recognize that where protective actions are taken will not necessarily correspond exactly to PAG contours on map	X	X	X
Recognize that many other non-technical factors (geographical, social, etc) can inform protective action decisions	X	X	X
Recognize what details/quantities the contours on PAG map represent including inputs, assumptions, and limitations	X	X	X
Identify the typical examples of recommendations the advisory team can give	X	X	
Describe and differentiate a PAG and a PAR and how they are used	X	X	X

Demonstrate public speaking skills	EOC Support	ICP Support	Branch /Division
Demonstrate ability to convey technical information to a non-technical audience	X	X	X
Demonstrate the ability to communicate effectively with workers in the field as well as with Sr. leadership	X	X	X
Demonstrate effective public interaction skills (eye contact, effective language, body language, etc.)	X		
Demonstrate ability to effectively relate risk to the public	X		
Demonstrate ability to analyze scientific information and convey the associated risk with accuracy and appropriate language skills	X		

Specific ICS/MACS Training	EOC Support	ICP Support	Branch /Division
Introduction to Incident Command System, ICS-100	X	X	X
ICS for Single Resources and Initial Action Incidents	X	X	X
ICS-300 Intermediate ICS for Expanding Incidents	X	X	
ICS-400 Advanced ICS	X	X	
National Incident Management System (NIMS) An Introduction	X		
NIMS Multiagency Coordination System (MACS) Course	X		
National Incident Management System (NIMS) Public Information Systems	X		
NIMS Resource Management	X		
National Response Framework, An Introduction	X		
IS-3: Radiological Emergency Management	X	X	X
IS-301: Radiological Emergency Response	X	X	X
IS-302: Modular Emergency Radiological Response Transportation Training	X	X	X

Appendix B: ROSS Skills, Knowledge, and Abilities

This section identifies the Skills, Knowledge, and Abilities (SKAs) that are important for the ROSS candidate to have, and what level of proficiency. Required proficiency was defined using HHS Proficiency Scale.

Proficiency Level	Description
Not Applicable	You are not required to apply or demonstrate this competency. This competency is not applicable to your position.
Awareness (basic knowledge)	You have a common knowledge or an understanding of basic techniques and concepts. Focus is on learning.
Novice (limited experience)	You have the level of experience gained in a classroom and/or experimental scenarios or as a trainee on-the-job. You are expected to need help when performing this skill. Focus is on developing through on-the-job experience; You understand and can discuss terminology, concepts, principles, and issues related to this competency; You utilize the full range of reference and resource materials in this competency.
Intermediate (practical application)	You are able to successfully complete tasks in this competency as requested. Help from an expert may be required from time to time, but you can usually perform the skill independently. Focus is on applying and enhancing knowledge or skill; You have applied this competency to situations occasionally while needing minimal guidance to perform successfully; You understand and can discuss the application and implications of changes to processes, policies, and procedures in this area.
Advanced (applied theory)	You can perform the actions associated with this skill without assistance. You are certainly recognized within your immediate organization as "a person to ask" when difficult questions arise regarding this skill. Focus is on broad organizational/professional issues; You have consistently provided practical/relevant ideas and perspectives on process or practice improvements which may easily be implemented; You are capable of coaching others in the application of this competency by translating complex nuances relating to this competency into easy to understand terms; You participate in senior level discussions regarding this competency; You assist in the development of reference and resource materials in this competency.
Expert (recognized authority)	You are known as an expert in this area. You can provide guidance, troubleshoot and answer questions related to this area of expertise and the field where the skill is used. Focus is strategic; You have demonstrated consistent excellence in applying this competency across multiple projects and/or organizations; You are considered the "go to" person in this area; You create new applications for and/or lead the development of reference and resource materials for this competency; You are able to diagram or explain the relevant process elements and issues in relation to organizational issues and trends in sufficient detail during discussions and presentations, to foster a greater understanding among internal and external colleagues and constituents.

Adapted from the NIH Proficiency Scale (January 12, 2009).

There are several categories of SKAs evaluated:

Radiation Protection

It is expected that ROSS candidate would likely come from Health Physics / Radiation Protection programs within the state or local community and the ROSS personnel would have a strong radiation protection background baseline knowledge. For this reason the fundamental Health Physics knowledge required to pass part 1 of the American board of Health Physics was used as a metric for Radiation Protection knowledge.

Radiological Response

Beyond the basic understanding of radiological issues, the ROSS needs to understand the federal response structure, tools, and assets that can be used during a response.

NIMS/ICS

Understanding of non-radiological response doctrine is required to integrate into the response.

Skills and Response Capabilities

There are many physical skills and abilities required for the ROSS position, these include good communication skills and the ability to rapidly deploy and work long hours in austere conditions.

Basic Health Physics Knowledge

Note: Passing Part 1 of the ABHP Exam represents at least an "Intermediate" proficiency in all categories. CHP or PhD in Radiological Health Physics represents at least "Advanced" in all categories. NRRPT Certification represents at least a "Novice" proficiency in all categories.

	ROSS Minimum Knowledge		
1. Measurements and Instrumentation	**Type 1 (Highest)**	**Type 2**	**Type 3**
1.1 Types of Measurements	Intermediate	Novice	Novice
1.2 Selection of Instruments	Intermediate	Novice	Novice
1.3 Analytical Techniques for Sampling	Intermediate	Novice	Novice
1.4 Measurement Methods	Intermediate	Novice	Awareness
1.5 Interpretation and Reporting of Results	Intermediate	Novice	Awareness
1.6 Quality Control and Data Quality Objectives	Awareness	Awareness	Awareness
1.7 Instrument Calibration, Maintenance, and Performance Testing	Novice	Awareness	Awareness
2. Standards and Requirements	**Type 1 (Highest)**	**Type 2**	**Type 3**
2.2 History and Development (regulation basis and past exposures and events)	Intermediate	Novice	Awareness
2.3 Use and Application	Intermediate	Novice	Awareness
2.4 Types of Regulations (jurisdiction / authorities)	Intermediate	Novice	Awareness
2.5 Interpretation and Knowledge	Intermediate	Novice	Awareness
3. Hazards Analysis and Controls	**Type 1 (Highest)**	**Type 2**	**Type 3**
3.1 Hazard Identification	Novice	Awareness	
3.2 Evaluate and Assess Significance/Consequence	Novice	Awareness	Awareness
3.3 Devise and Implement Controls	Intermediate	Novice	Novice
3.4 Types of Engineered Controls	Novice	Awareness	
3.5 Designs and Specifications	Novice	Novice	Awareness
3.6 Selection and Evaluations (PPE, dosimetry, shielding, & decon)	Intermediate	Novice	Novice
3.7 Use and Operations	Awareness	Awareness	Awareness
3.8 Document and Communicate	Novice	Novice	Awareness

4. Operations and Procedures	Type 1 (Highest)	Type 2	Type 3
4.1 Standard Operating Practices and Procedures	Intermediate	Novice	Novice
4.2 Emergency Response (see Radiological Response Knowledge and Tools)	Advanced	Intermediate	Novice
4.3 Basis for Operations and Program	Novice	Novice	Awareness
4.4 Program Types	Novice	Awareness	
4.5 Records	Novice	Awareness	

5. Fundamentals and Education	Type 1 (Highest)	Type 2	Type 3
5.1 Skills of the Trade - explain	Intermediate	Intermediate	Novice
5.2 Types	Novice	Novice	Awareness
5.3 Other Fundamentals	Intermediate	Intermediate	Intermediate

Note: these are taken from CHP required knowledge categories

Radiological Response Knowledge & Tools

RR1. Models and Software Tools	Type 1 (Highest)	Type 2	Type 3
RR1.1 Atmospheric Dispersion Modeling (e.g. Hot Spot, RASCAL, HPAC, NARAC)	Novice	Awareness	Awareness
RR1.2 Dose Assessment Modeling (e.g., RESRAD-RDD & TurboFRMAC)	Awareness	Awareness	
RR1.3 Monitoring Planning (10 point strategy, MARSIM Methodology, & Visual Sample Plan)			
Emergency Monitoring Strategies (e.g., 10 point Strategy)	Intermediate	Intermediate	Intermediate
Software tool (e.g., Visual Sampling Plan (VSP) & MARSIM)	Awareness		
RR1.4 Information Management / Data Telemetry / Databases			
RadResponder	Intermediate	Intermediate	Intermediate
CMWeb	Intermediate	Novice	Awareness
HSIN	Novice	Awareness	Awareness
RR1.5 FRMAC/IMAAC Product Interpretation & Customization	Intermediate	Intermediate	Novice
RR2. Radiological Response Standards and Guidance (e.g., NCRP, ICRP, ANSI, & IAEA - see references)	Intermediate	Novice	Awareness
RR3.0 Response Doctrine and Framework	**Type 1 (Highest)**	**Type 2**	**Type 3**
RR3.1 Federal, State, and Local Radiological Response Doctrine (Federal, State, and Local Plans manuals frameworks, & playbooks - see reference list)	Intermediate	Novice	Awareness
RR3.2 Federal Radiological Response Assets & Capabilities			
Advisory Team for the Environment, Food, and Health	Intermediate	Intermediate	Novice
FRMAC	Intermediate	Novice	Awareness
All other resources (see ROSS Resource Guide)	Novice	Awareness	Awareness
RR3.3 State Radiological Response (e.g. implication of a NRC agreement vs. non-agreement State & Impact on Home Rule vs Dillon Rule governance)	Intermediate	Novice	Awareness
RR4. Radiological Threats	**Type 1 (Highest)**	**Type 2**	**Type 3**
Understanding Radiological Terrorism, sources of concern, and potential impacts	Intermediate	Novice	Awareness
Understanding Nuclear Terrorism and potential impacts	Intermediate	Novice	Awareness