

IMPACTS ON POWER REACTOR HEALTH PHYSICS PROGRAMS

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ABSTRACT

The impacts on power reactor health physics programs from implementing the revised 10 CFR Part 20 will be extensive and costly. Every policy, program, procedure and training lesson plan involving health physics will require changes and the subsequent retraining of personnel. At each power reactor facility, hundreds of procedures and thousands of people will be affected by these changes. Every area of a power reactor health physics program will be affected. These areas include; ALARA, Respiratory Protection, Exposure Control, Job Coverage, Dosimetry, Radwaste, Effluent Accountability, Emergency Planning and Radiation Worker Training. This paper presents how power reactor facilities will go about making these changes and gives possible examples of some of these changes and their impact on each area of a power reactor health physics program.

IMPLEMENTATION PROCESS

Each power reactor facility will use basically the same process to implement the revised 10 CFR Part 20 (NCRP & ICRP Guidance), henceforth referred to as the revised regulations. This process involves the following steps:

Interpret

What does it mean ? What is acceptable for compliance ? The revised regulations, although interpreted and explained by the Nuclear Regulatory Commission (NRC) in the federal register, will need further interpretation of its meaning and intent. Although some regulatory and industry guides will be issued, many interpretations will still be necessary and these interpretations may or may not stand the test of time as regulators and licensees rehash the meaning, the intent and what is acceptable for compliance with the revised regulations for years to come.

Reach Agreement/Consensus

No one individual at a power reactor facility will make all the interpretations or decisions on how best to comply with the revised regulations. So at every step along the way toward implementation, it will be necessary to obtain agreement and/or consensus with health physics cohorts, fellow workers, management and the industry health physics community as a whole, if possible.

The individuals responsible for implementing the revised regulations will seek out information, advice and consensus from the rest of the power reactor industry and the regulators in interpreting and implementing the revised regulations. This will be an ongoing effort that will continue well after the revised regulations become law.

Identify Affected Areas

Every policy, program, procedure, computer program and lesson plan concerning and related to health physics will be reviewed for the potential of it being affected by the revised regulations. This includes not only health physics procedures, but may also include other disciplines' procedures, such as maintenance, operations, engineering, etc. The degree of impact on other disciplines' procedures will vary depending to what extent these other disciplines have incorporated health physics instructions into their specific procedures.

Select Implementing Methods

Decisions on the practical and compliant implementation of the regulations and what and how areas of the health physics program will be affected will be necessary. There will be many ways to implement the revised regulations depending on interpretations of the revised regulations and present health physics program requirements. These decisions will weigh the most practical and cost-effective options in order to comply with the revised regulations. It will be important to select methods that result in the minimal impact to the program, the people that operate the program and the radiation workers.

Identify Potential Changes

After the methods of implementation are determined, the specific changes to the areas of the health physics program will be further defined and identified. At this point a good estimate of the cost associated with the revised regulations can be determined.

Agree on Changes

Again agreement and consensus will be necessary on all changes and their expected impact on the health physics program. Deciding on changes in-it-of-itself may be the easy part. Applying these changes and determining how these changes will impact the health physics program and the attitude and work of the radiation workers is the more difficult part.

Implement Changes and Test

It will take a tremendous work effort to revise and review all the changes to the procedures and the computer programs of the health physics program. This process will involve many reviews and trial runs by everyone in the health physics organization. Most power reactor facilities will probably contract health physics professionals and consultants to assist with the implementation of the revised regulations. This will place a further demand on the already short supply of professional health physicists which will, more than likely, further drive up the cost of implementation.

Retrain Personnel

All personnel will need to be retrained. This includes managers, radiation workers, health physics personnel, engineers, training personnel, etc. The health physics and training personnel will have the most to relearn and comprehend. This will not be an easy task. The training and educating of the health physics personnel will not be accomplished by a few days of classroom training. This process will take years before health physics personnel are comfortable with the new risk-based system and terminology of the revised regulations.

Monitor and Fine Tune

After implementation, power reactor health physicists will be watching and learning from each other for the most effective and efficient methods to comply with the revised regulations. Additional changes will be necessary to the programs as the regulators and industry sort out the interpretation and the practicalities of implementing the revised regulations. I anticipate many regulatory infractions as further understanding and consensus is reached between health physicists in industry and in regulatory groups.

GENERAL IMPACT

Every area of a power reactor health physics program will be affected by these revised regulations. Some areas will be changed and affected more than others. Some of these impacts will be beneficial, other impacts will be disruptive with no clear improvement or benefit to the program. Some areas will need to be completely revamped. The cost to comply with the revised regulations will be between \$1 and \$3 million per power reactor facility.

This paper neither discusses the technical basis and reasons for the revised regulations nor tries to explain the terminology and the specifics of the regulations. This paper expresses an opinion on the possible impacts to a power reactor health physics program as a result of the revised regulations.

Many people disagree on the impacts, costs and benefits of the revised regulations. Although as a professional health physicist I have mixed thoughts and feelings with the revised regulations, overall I believe the revised regulations are creating more cumbersome and confusing health physics programs for the workers, the public and the operational health physicists.

HEALTH PHYSICS PROGRAM IMPACTS

There will be many major and minor changes and impacts to each area of a power reactor health physics program as a result of these revised regulations. The following sections briefly discuss some of the major changes and their possible impact to power reactor health physics programs. In many cases it is difficult to predict specific changes because it depends on interpretations of the revised regulations and existing program procedures and methods.

ALARA

Power reactor health physics programs already have detailed and extensive ALARA programs so the revised regulations will require little change to the existing ALARA programs. However, there will be some impacts. There will be impact from the change in the present regulation wording of "should" to the revised regulation wording of "shall".

Under the present regulations, power reactor facilities have not been cited by the regulators for having questionable ALARA programs and practices. However, the use of "shall" in the revised regulations provides the tool to cite licensees that are perceived as not being "ALARA". Since this is a very subjective call, this will be a controversial area of the revised regulations. Remember, ALARA is a principle of radiation protection and is very subjective.

Another impact will come from trying to balance the relatively insignificant internal doses with the external doses. Although the revised regulations imply that internal dose should be avoided or minimized, the revised regulations add the caveat that this is should be done, "consistent with maintaining the total effective dose equivalent ALARA." This is going to be easier said than done.

Power reactor health physicists have always disproportionately spent more effort worrying and dealing with internal doses than external doses. Power reactor health physicists have convinced themselves, the workers, the public and the industry and government regulators that internal dose should be avoided at all costs, even at the expense of external dose. This paradigm is not going to be overcome by this new, "ALARA consistency" wording in the revised regulations.

Respiratory Protection

Although the general requirements for using and controlling respiratory equipment will not change, the air sampling requirements and controls will be more extensive. The revised regulations will necessitate increased use and sophistication of air sampling when there is any chance of significant internal exposure.

The health physics job coverage of radiation work will require more air sampling when internal exposure is contributing to the total dose. This will increase the external dose to the health physics technicians providing the job coverage. This area of a power reactor health physics program will further evolve as facilities and regulators struggle to obtain the most effective methods and controls for complying with the revised regulations.

Exposure Control

The day to day control of workers' exposure to radiation will be more cumbersome and difficult because both external and internal exposures will have to be considered before and after the exposures, and prior to performing subsequent work in radiation control areas. Although most jobs at power reactor facilities do not involve internal exposure, the record systems, procedures, computer programs and health physics personnel's knowledge will have to be changed to deal with internal, as well as, external exposure control.

The revised regulations only require the summation of internal and external dose if monitoring is required. Monitoring is required if either 10% of the internal or external limits are expected to be exceeded.

Since power reactor health physicists presently "monitor" everyone who enters the radiation control areas of a power reactor facility for both external and internal exposure, this can be interpreted as requiring the summation of the internal and external doses regardless of the 10% rule. This interpretation is analogous to the present practice of reporting doses that are less than 25% of the limits for radiation workers who are monitored for external dose, although monitoring is only required when doses are expected to be greater than 25% of the external limits.

Another impact and source of confusion will be from the different summing and reporting practices. Some licensees will routinely sum the doses and other licensees will not. Since many radiation workers travel from facility to facility this will lead to confusion and loss of productivity, especially among the traveling contract health physicists.

Job Coverage

The control of jobs in radiation control areas will be more difficult and complex than before. As previously mentioned, both external and internal exposure will have to be further considered and controlled by the health physics technicians in the work place. This may prove not to be an easy task. Although most jobs do not involve significant internal exposure, almost all jobs have the potential for internal exposure and regardless of the frequency of internal exposure, the health physics programs must have the policies, procedures and trained health physics personnel in place to control and sum the internal and external doses.

The following is an example of the increased job coverage that may be required. If a worker's internal exposure is being monitored, then the health physics technician will have to control both the stay time to the external source and the internal source by dosimeter and air sampling. At the completion of the job, and before the worker can work on another job, the internal dose from the air sample results and the dosimeter results will have to be determined and summed.

Dosimetry

The complete "bookkeeping", that is, record system of the dosimetry program will have to be changed. All of the forms, computer programs, reports, procedures, policies and lesson plans will require revision to incorporate the new terminology of the risk-based system of the revised regulations. The retraining of the health physics personnel at all levels will not be a trivial task.

The revised system is confusing and difficult to understand. For example, there are nine different terms of dose that share the same unit of rem. They are:

Dose Equivalent	Eye Dose Equivalent
Shallow Dose Equivalent Skin	Shallow Dose Equivalent Extremity
Deep Dose Equivalent	Effective Dose Equivalent
Committed Dose Equivalent	Committed Effective Dose Equivalent
Total Effective Dose Equivalent	

This will cause a lot of confusion and frustration among the workers and the health physics personnel.

Radwaste

It is not clear what impact the revised regulations will have on the radwaste program. It is clear that *it will not reduce the volume or activity of the radwaste which is the public's primary concern.* The greatest potential impact appears to be on the 10 CFR Part 61 regulations that address the dose from shallow land burial. Going to a risk-based system necessitates the conversion of the dose limits throughout the regulations from dose equivalent to total effective dose equivalent. As previously pointed out, the actual impact will depend on the interpretation of the revised rules and, in this case, how they affect associated regulations such as 10 CFR Part 61.

Effluent Accountability

This area of a health physics program could greatly be affected by the revised regulations. The risk-based system will require changes in the dose models used to site, construct and operate a power reactor facility. Although most people recognize that the dose from power reactor facilities to the public is insignificant compared with other environmental sources of dose, the revised regulations will require modifications of the existing dose pathway models and methodology for effluent accountability. The "bookkeeping" or calculated dose will change, but the actual dose will not change.

The following is another example of the potential impact from these revised regulations. Presently, power reactor facilities set the instantaneous release rate alarm set points on their air and water effluent monitors at concentrations that, if continuously released for one year, would exceed 500 mrem to the public. Since the new limit to the public has been lowered to 100 mrem, does this mean that the alarm set points should be lowered by a factor of 5 ? If so, some power reactor facilities will require new effluent monitors which will cost millions of dollars.

Emergency Planning

Although the revised regulations do not specifically address emergency planning doses at power reactor facilities, the risk-based system in the revised regulations will have an impact on emergency plans. The Environmental Protection Agency (EPA) has already recommended a partial risk-based change to the Protective Action Guides (PAGs).

Protective Action Recommendations (PARs) for the public can be based on projected doses to the whole body and the thyroid of the affected public. The application of the risk-based system would drastically change the PAGs. It will add more uncertainty and conservative assumptions to the already cumbersome methodology and procedures for making PARs from projected radioactive releases.

If any changes are made to the present power reactor emergency plans they should simplify, not further complicate, the already meaningless and overly conservative dose projection requirements of the emergency plans.

Radiation Worker Training

This area of a health physics program will require the most changes and efforts. Everyone who works at a power reactor facility will have to be retrained. The revised regulations will further confuse the public and the work force. It is not a simple matter of retraining everyone, it takes years of experience using the new terminology and operating the revised health physics programs before the health physic personnel, the regulators, the workers and the public will reach the present comfort level with the regulations. Even the present level of understanding and comfort is not where it needs to be. We are creating a nightmare for the operational health physicist, the regulators and the public.

SUMMARY

On paper and "in-theory", the risk-based system that the revised regulations implements is more logical and clarifies some of the short-comings and misconceptions of the present regulations. In principal the new risk-based system is simple and intuitively logical. Simply stated; for any type of radiation and any part or organ of the body exposed by any means, the radiation dose is calculated, weighted and summed to determine the overall risk to the individual.

In practice the conversion of our present health physics programs to the revised regulations will not be simple and straight-forward. It will be a major, costly undertaking which will take years to reach the degree of comfort, uniformity and understanding that presently exists.

The revised regulations will only make sense and serve the needs of a few theoretical and highly technical health physicists. The vast majority of the operational health physics community, the radiation workers, the public, and other professions involved with the use of radiation, such as managers, lawyers, engineers, etc., will be further confused, misled and frustrated because of the revised regulations.

There will be no net dose savings to the radiation workers and the public as a result of these revised regulations. Almost all of the changes are to the "bookkeeping" of peoples' radiation doses. As a professional health physicist, I join with others and say, "the emperor has no clothes". These revised regulations will not benefit the profession, the workers, or the public. They will only cost our society more resources chasing little or no benefit. Where is the rational pursuit for the safe and cost-effective use of radiation for the benefit of man and his environment ?