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TITLE: STANDARDIZED RADIOLOGICAL HAZARD ANALYSIS FOR A BROAD BASED OPERATIONAL SAFETY PROGRAM

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STANDARDIZED RADIOLOGICAL HAZARD ANALYSIS FOR A BROAD BASED OPERATIONAL SAFETY PROGRAM

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ABSTRACT

The Radiological Hazard Analysis (RHA) Manual provides a methodology and detailed guidance for systematic analysis of radiological hazards over a broad spectrum of program functions, housed in a wide variety of facilities. Radiological programs at LANL include: research and experimentation; routine materials operations; production; non-destructive examination or testing; isotope and machine produced radiations; chemistry; and metallurgy. The RHA permits uniform evaluation of hazard types over a range of several orders of magnitude of hazard severity. The results are used to estimate risk, evaluate types and level of resource allocations, identify deficiencies, and plan corrective actions for safe working environments.

INTRODUCTION

Laboratories within the U.S. Department of Energy are undergoing significant changes in the manner by which they conduct operations. Operational Health Physics groups are not an exception. With budgetary constraints becoming more severe, staffing and resources strained or severely limited, methods had to be devised to provide equal or better service in spite of the hardships. Standardization of the methodology and consistency of evaluating the types and levels of radiological hazards involving several hundred projects in over 150 facilities, spread over 43 square miles, was essential for the operational Health Physics personnel. The Standardized Radiological Hazard Analysis Manual was determined to be one of several practical working tools for Health Physicists in the field. The 300 page manual starts with a detailed index from which an analysis plan is constructed. Once in the field, the use of the manual index provides ready access to guidance, assessment details, and forms for other hazards or issues that were either unexpected or not obvious during the initial assessment. The guidance contained in the manual is detailed, but allows for independent input by each Health physicist that uses it. The training on the use of the RHA Manual emphasizes that the guidance should be used as a tool to direct and focus analysis thought processes, but should not limit the RHA performance to merely a check list task.

Data from the detailed Radiological Hazard Analysis report sheets is subsequently input to a commercially available relational database which is both an analysis tool and the database for each and every facility for which a Radiological Hazard Analysis has been performed.

Blank pages of forms and reports are obtained from stock to replace those used from the binder to be ready for the next facility analysis.

DEVELOPMENT OF THE RHA MANUAL

There are existing methodologies for risk assessments of specific processes, and a few for multi-function facilities. The Nevada Operations Office of the DOE produced the 150 page "Radiological Safety Functional Appraisal and Program Review Guide," in 1990. (Do90) This has direct application to DOE/NVO facilities. It is based upon a radiological environmental program. A method for determining hazard classifications of DOE facilities was developed at Battelle PNL (Lu91). The hazard classification required a walkthrough by an inspection team of persons with considerable expertise in the various disciplines. More than one DOE Operations Office required the technique to be used by operating contractors of DOE facilities, to determine gross hazard classification values for their facilities. These determinations were not sufficiently in-depth to provide the level of detail LANL felt to be necessary for our operational hazard evaluations. The technique also did not provide useful data regarding operational hazards routinely faced by facility operations personnel, or health and safety support personnel.

The concept of the Standardized Radiological Hazard Analysis Manual was originated by one of the authors (LA). With access to a consultant with a broad spectrum of "hands-on" experience in the field of Health Physics, Industrial Hygiene, and Radiological Environmental Monitoring Programs, the project was undertaken.

The manual was conceived as a light-weight, notepad-sized document with outline formatted "reminders" for review while doing field facility walk-throughs. The document is now about 300 single side printed pages, maintained in a three inch thick binder, and requires training in its use to provide familiarity and a reasonable level of surety that it will be used uniformly by the trained staff.

Each type of radiological facility or operation was considered as an independent unit during the drafting of the RHA Manual. Details from observations, physical measurements, radiological measurements, locations of components, and similar pertinent data, are called out in the text of each hazard analysis section. In the initial draft, in both the manual and the software, each hazardous item was separate, as was each mitigation process, and was considered only for that room, building, or process. Subsequently, common items, such as glove boxes, filtrations, detection and alarm systems, were coded in the relational database software. This served to provide more rapid input, reduction in errors, and conservation of RAM and storage required by the computer program.

Hazard levels, risk assessments and hazard mitigating equipment or engineered features are analyzed in the software. All values obtained from the analytical results, relate to hazards present during normal operational circumstances. No attempt has been made to extend the analysis into accident scenarios. With the availability of information regarding radionuclides, inventory on hand, physical and/or chemical form, and details of the

monitoring systems, and ventilation systems, assessing limited accident scenarios remains a possibility.

Each developmental iteration has only expanded the size of the overall program, both software and Manual. Some future consideration may be to purchase the relational database "engine", and write the specific RHA database applications program. Several advantages would be, easier commercial or public domain releases of the software component which could save 50% of the RAM occupied by features that are not used from the standard database product. Time savings could be realized by having direct page access to pertinent input requirements, rather than have to page through irrelevant subject matter to arrive at the appropriate page for the next input.

TYPES OF FACILITIES INCLUDED

The RHA Manual is designed to be used to evaluate radiological hazards associated with the following programmatic elements:

Research and Experimentation: explosion dynamics; armor, anti-armor; criticality; weapons enhancement; controlled thermonuclear reactions; free electron lasers,

Routine Operations: reactor operations; radioactive waste management; weapons production related operations; weapons testing operations; retirement storage operations,

Production: quality control; materials purity; lathe and milling shop operations; purification; enrichment; weapons related activities; medical aspects of LAMPF operations; X-ray crystallography confirmations,

Non-Destructive Examination or Testing: fixed X-Ray radiographic facilities; fixed facility Van de Graaf radiography; high speed x-ray of explosive events; portable radiographic unit safety; eddy current testing of radioactive materials; magnaflux testing of radioactive materials; betatron narrow beam, thick target radiography,

Isotope Produced Radiations: calibrations; sealed source radiography; activated accelerator component radiological protection; heat source radiological protection; incidental weapons component exposure control; weapons debris analysis; reactor fuel processing hot cell operations,

Machine Produced Radiations: Los Alamos Meson Physics Facility; IBF tandem Van de Graaf; single stage Van de Graaf; free electron laser; plasma focus devices; pulsed power conversion; health center x-rays; neutron generator facility; electron guns; ion implantation,

Chemistry: analytical; alloy; quality control; quality assurance; medical isotope purification hot cell operations,

Metallurgy: analytical; developmental; design improvement; stability improvement; yield improvement; induction heating; laser isotope separation,

Transportation: On-site, inter-area, intra-area, for safety and compliance with State and Federal shipping requirements on public roads,

Compliance Assessment: Confirm compliance with Health and Safety

requirements imposed by all applicable State, Federal Agency requirements, laws, DOE Orders.

In the above 10 major areas, each of the 56 categories of operation, project, or facility has its own set of RHA forms. Each analysis must be independent in-so-far that it is not a component of a larger complex. If the latter is the case, the RHA forms are grouped into a facility package. The results of the full analysis of the units as a system will result in a different hazard rating because of the concurrent and dependent mode of operation.

CONCLUSIONS

Present operating facility inspections are performed with a perspective focused on the problem of immediate concern. The use of the RHA Manual will provide consistency for such evaluations. Performing full facility radiological hazards analyses will accomplish several objectives: Advance knowledge of the facility's or operation's hazards; provide a global perspective of concurrent but unrelated hazards of adjacent operations; consistent or uniform approach to evaluations and solutions; applications of "lessons learned"; greater confidence to younger professionals in the Health Physics Groups; a cross-training tool for professionals and technicians not familiar with areas outside of their duty areas; a computerized database with rapid access for rapid retrieval for the line organization, security, fire, and emergency response teams. Two peripheral uses of the RHA Manual may be:

1. The RHA may have use as a formal tool during the drafting of facility Safety Analysis Reports (SAR) and Updated Safety Analysis Reports (USAR).

2. There may be some value in training the facility supervision to use the system, to provide them with the capability to perform more frequent reviews of their facilities than can the limited staff of operational Health Physicists. This is beneficial for the Laboratory through the heightened awareness for radiological hazards in the workplace.

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REFERENCES

Do90 U.S. Department of Energy, Nevada Operations Office, Environmental Compliance Branch, Environmental Protection Division, Las Vegas, Nevada. "Radiological Safety Functional Appraisal and Program Review Guide". (1990)

Lu91 Lucas, D.E., A Practical Approach to Hazard Classification, Rev 1., Battelle, Pacific Northwest Laboratories, Richland, Washington. March 1991.

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