NOV 9 1964

LA-AC-6679

CONF-808-1

THE ROLE OF THE HEALTH SURVEYOR*

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Recent technological advances in nuclear science have created many new health problems. Health physics, which is engaged in developing radiation safety policies and methods for radiation measurements, is one of the new disciplines created by an expanding nuclear technology. In addition to health physicists, many organizations employ men who monitor radioactive operations; these men have various designations, depending upon the installation where they work. At Los Alamos, the fieldmen of health physics are designated as health surveyors. These men act as liaison between the health physicists, who develop health protection programs, and personnel operating with radioactive materials. In many cases, the health surveyor deals directly with operating personnel and their supervisors. In the hands of the health surveyor rests the safety of the operator and the responsibility for training the operator in radiation protection. The health surveyor receives from the health physicist a program for radiation protection and, like a salesman, he must sell this program to the operating organization.

In my first interview my employer told me that "the ability to get along with people" was probably the most important character-

*Work done under the auspices of the U. S. Atomic Energy Commission.

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istic of a good health surveyor. At the time, I could not understand his statement, but I never forgot it. When I began working in the field I learned that, for the most part, the authority of the health surveyor is suggestive and educational, and only then did the importance of good human relations become apparent to me.

The following is a typical example. The health surveyor realizes the importance of quickly removing loose radioactive dust; he knows that the longer it remains, the greater the chance for fixed contamination or tracking, and that if the dust becomes airborne it can be an inhalation problem. If the surface dust contamination is above the plant operating level it is promptly removed, but if it is less than the plant operating level, prompt removal is not always easy to accomplish. The health surveyor is aware that the operating personnel must expend time, money, and effort to carry out a job that is not essential to their operation. The health surveyor must rely upon his ability to get along with people to convince the operators of the value of reducing a potential radiation hazard before it becomes an actual radiation hazard. He must sell the program of health protection as good health insurance and good management of the dollar. A potential hazard often requires the health surveyor to exercise more ingenuity than an obvious accident.

In addition to the ability to get along with people, the following are important factors in a good working relationship between the health surveyor and the operating group.

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1. The health surveyor must create respect for radiation safety. Operators working with radioactive materials have learned respect for the rules of radiation safety when they refuse to take a non-approved short cut, even though the health surveyor would not be aware of the short cut.
2. When assigned to an operation, the health surveyor must anticipate, as far as possible, what equipment he will need to assure radiation protection, and he must have in mind a practical health protection program. Operators are busy people, frequently working under the stress of a crash program, and they cannot permit unnecessary delays.
3. The health surveyor must be ready to make practical compromises so long as it does not impair radiation safety, and he should never act in a dictatorial manner. The health surveyor should back up requests with handbooks and standard operating procedures. He must remain with the operators as long as they are working. Above all,

the health surveyor must remain constantly alert.

Health surveyors must make themselves a part of the operation so that it runs smoothly and efficiently.

4. The health surveyor must keep the supervisors of operating personnel informed of the latest information about radiation safety problems in their area. More important, the health surveyor must keep the health physicist informed of the activities of the operating personnel so the health physicist can formulate a realistic radiation safety program.

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The following suggestions are offered to enable the health surveyor to appraise himself.

1. Make frequent inspections of the entire area. Nothing can beat "seeing for yourself."
2. Note work being done. Ascertain when you will be needed, be ready, and be there on time.
3. Be familiar with the operation of all equipment, but do not yourself operate any equipment which is not specifically assigned to you.
4. Locate radiation hazards and make necessary arrangements to remove the hazards.
5. Check incoming supplies and equipment; they offer clues as to future operations.

6. Encourage the operating supervisor to talk over his plans with you and then plan with him for the safety of his men.
7. Examine work orders dealing with repairs and modifications, and provide whatever radiation safety is needed.
8. Keep a close check on all automatic radiation meters. Not only is a frequent check of these meters important to insure their correct operation, but they can also serve as clues to changing radiation conditions in operating areas.
9. Keep careful watch over visitors in the area. Ascertain where they are going and why, and see that they wear the necessary protective clothing, dosimeters, and film badges. Direct them to their destination and accompany them in hazardous areas.
10. Report malfunctions and unusual occurrences. Report immediately such information as loose belts, hot machinery, unusual noises, oil leaks, stopped machinery, unusual air currents, or the absence of normal air currents.
11. See that all radioactive materials are properly labeled, tagged, and stored. Rope off, label, and tag all over-tolerance areas.

12. Hand surveying is tedious and monotonous, especially for alpha activity, yet it must be done carefully, frequently, and completely. Omission may result in a serious health hazard.
13. Report contamination immediately. If liquid or dust, it may be tracked, or if dust or gas, it may be inhaled.
14. Violators of radiation safety rules must be treated kindly but firmly, and should be reported to their supervisors immediately. Full information about the violation should be recorded, not only for the protection of the violator, but also for the protection of the health surveyor.
15. Careless personnel will soon be detected. Spend additional time with them; take advantage of the self-disciplining power of the group for the recalcitrant.
16. There is no magic in the work of the health surveyor. He must be on the job continuously. He must see, hear, and even anticipate radiation safety.
17. When pride in radiation safety techniques becomes evident, and when the health surveyor hears his own words being played back to him, he knows that he is making progress.

These suggestions which I have mentioned all contribute

to making a health surveyor effective in his job.

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Some of the common complaints heard about the health surveyor are:

1. He is not alert.
2. He expects operating personnel to come to him with problems, rather than anticipating the problems and making himself available.
3. He has not studied the details of the operation and, therefore, has no clear idea of what is going on.
4. When an operation begins, he does not have a radiation safety program in mind, and his health protection equipment and survey meters are not ready.

A good health surveyor will constantly check his performance in order to avoid complaints such as I have listed.

The health surveyor and his survey meter are inseparable. But contrary to the belief of many, the survey meter is not an accurate quantitative instrument - at best a ± 20 per cent

inaccuracy is accepted. The real purpose of the survey meter is

SLIDE to detect and locate radiation and to determine approximate dose

rates. Probably more experience is needed to learn how to make

an accurate survey reading and interpret it than any other phase

of the health surveyor's work. He must not only learn how to take

an accurate reading, but he must also be able to recognize factors

which result in inaccurate readings and how to cope with them.

When a health surveyor prepares to make a radiation survey, he should bear in mind the following:

1. When preparing to use a survey meter he should (a) follow the manufacturer's instructions carefully, and (b) always check the meter with a standard of known activity. Even though the meter may be equipped with a built-in standard, this may only check the operation of the circuitry.
2. Spurious high readings in alpha surveying may result from vibration, jarring, friction, and electrical interferences. Low readings may result from surveying damp surfaces, activity imbedded in a porous surface such as concrete, or vapors from decontaminants such as chloroethylene and alcohol.
3. Selection of the proper survey meter is important in gamma surveying. The health surveyor should be aware of the limitations and characteristics of all the survey meters he uses. For example, most G-M meters are adapted only for low-level surveying (less than 20 mr/hr); however, recently G-M meters with higher capacities have been developed. G-M meters have the advantage of being light weight, rugged, with rapid response and sensitivity to both beta and gamma

radiation, either mixed or separately. Unless a calibration curve is available, the G-M survey meter does not measure beta radiation in terms of radiation flux. A weakness of G-M meters is energy dependence; that is, the response of the instrument is not the same as that of air or tissue for all radiation energies. Saturation, often seen as apparent lowering of dose rate as one moves a G-M tube to a region of higher radiation, is caused by operating the G-M meter in fluxes higher than the tube and circuit were designed to handle. Lower fluxes will cause saturation in a G-M tube that is near the end of its life.

4. The following are more examples of the type of meter information a health surveyor must have in mind.

Ion chamber meters are generally used for levels of radiation greater than 20 mr/hr. An exception is the Radector which is also useful at low levels. The Cutie Pie meter has a correction factor of 1 or less from 1.25 Mev to about 20 kev, meaning it is "safe" over this energy range - below 20 kev it is "unsafe."

The Radector ion-chamber meter requires no correction for gamma between 0.1 and 1.2 Mev.

In summary, the survey meter is the tool of the health

surveyor, and certain skills are necessary to use it efficiently.

The health surveyor often finds himself in the role of a teacher. Because of limited opportunity for formal training of operating personnel in radiation safety, the alert health surveyor uses spontaneous situations for on-the-spot training.

The following teaching methods have been successful:

1. With a meter, the inverse square law can be demonstrated and staying time can be determined at the same time.
2. Show how the glove box is superior to the open hood for handling particulate matter.
3. With a meter and a lead shield, show how shielding is determined.
4. Explain maximum permissible body dose.
5. With readings taken from two types of meters at the same location, explain and demonstrate why the readings may not be the same.
6. Explain why radioactive material with a long half-life is a greater health hazard than material with a short half-life.

In conclusion, the health surveyor is a liaison between the health physicist on the one hand and those operating with radioactive materials on the other. In his hands rests the safety of the operating personnel. He must be able to get along with people. He must be constantly alert. He must create respect for

his work. He must be able to work as part of a service organization. He must teach radiation safety to the operating personnel. He must not only know how to use his survey meters, but he must also be able to interpret them in terms of radiation safety. Most important of all, a successful health surveyor does not keep his eyes glued to the dial of his meter - he analyzes the total situation and applies his knowledge to assure the safety of the men depending upon him.