THE NEED FOR MODERNIZING THE AIR MONITORING INSTRUMENTATION AT U.S. NUCLEAR POWER STATIONS

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INTRODUCTION

Aerosol technology is a relative new science and much of the knowledge that we possess today about the behavior of airborne particles was not available until after most of the existing U.S. nuclear reactors were built. Thus of the 104 operating nuclear reactors I this country, 53 started operation between December 1969 and December 1979; 46 started operation between 1980 and 1990; leaving only 5 that started operation in the early 1990s. Meanwhile, the first quantitative study of deposition losses in sampling lines was published in 1972; monodisperse aerosol were not available for research until 1973; shelter bias in ambient weather shelters was first reported to the Nuclear Regulatory Commission in 1982; information about single point representative stack monitoring also was published in 1982; the magnitude of the deposition losses in small diameter inlet nozzles was published in 1988; and shrouded inlet nozzles were first used in 1989. Consequently it is not surprising that much of the air monitoring instrumentation at U.S. nuclear power plants is out of date and has not been performance

tested. Furthermore, based on what we know now, much of this instrumentation cannot be relied on for meaningful measurements in the vent of an accident that releases radioactive particles to the atmosphere.

SPECIFIC PROBLEMS

1. At some plants the stack is used for both filtered reactor containment air and unfiltered general exhaust air. The latter may contain inert dust from building maintenance work that can plug the sampling probe and the collection filter.
2. Many stacks have multiple inlet sampling probes, with the small inlet nozzles and multiple elbows and tees, which keep sampled particles from reaching the collection filter and radiation detector.
3. At some plants the bank of HEPA filters is bypassed until the stack monitoring system indicates that a radioactive release is occurring, and remain bypassed if the stack monitoring system is not working.
4. There may be leaks in the HEPA filters that are not detected by the stack monitoring system.
5. The stack monitoring probe may be located where it does not receive a representative sample of the airborne particles leaving the stack.
6. The sampling flow rate may decrease as the collection filter become loaded with particles.
7. In many installations a flowmeter is located downstream from the collection filter where its calibration changes as the filter become loaded with particles.
8. There is frequently no vacuum gauge to indicate the pressure drop across the collection filter and the load limit for constant flow operation.
9. There can be leakage in filter holders and charcoal cartridge holders which reduces the amount of air that passes through them.

10. Weather shelters for ambient monitoring may have limited openings that prevent free airflow to the equipment inside.
11. Many instrument suppliers are not equipped to test their products for flow control, leakage, and deposition losses.

THE NEED FOR A CRITICAL REVIEW

Because of the many problems that may exist, there is a need for a critical review of the present airborne particle monitoring systems before a radioactive release occurs that is not detected by them. There are three steps in making such a review, for which professional assistance is needed:

1. An on-site survey of the existing systems, including obvious deficiencies, and the facilities that are needed for testing them.
2. Quantitative performance testing with particles that simulate releases of airborne radioactivity;
3. Recommendations for upgrading deficient systems and components.

With the help of station personnel, step 1 should require no more than one man-week of a consultant's time for each reactors, and will provide essential information for estimating the costs of steps 2 and 3.

OTHER NEEDS

4. Written guidelines for conducting performance tests which can be taught to station personnel and to the suppliers of replacement components.
5. Independent third party verification of the work that is done so that it will be accepted by courts if the need arises.

BENEFITS

A critical review of the existing air monitoring instrumentation and the improvements resulting from it will benefit all concerned by facilitation the early detection and reduction of radioactive releases when they occur. It also will assist in assuring critics of nuclear power that risk management is being taken seriously. This in turn will help to gain support for more nuclear power plants, which are badly needed in this country for supply clean electrical power.