TABLE 4.3-2

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST	MODES IN WHICH SURVEILLANCE REQUIRED
1. SAFETY INJECTION, TURBINE TRIP, FEEDWATER ISOLATION, AND MOTOR DRIVEN AUXILIARY FEEDWATER PUMPS				
a. Manual Initiation	N.A.	N.A.	M(1)	1, 2, 3, 4
b. Automatic Actuation Logic	N.A.	N.A.	M(2)	1, 2, 3, 4
c. Containment Pressure-High	S	R	M(3)	1, 2. 3
d. Pressurizer Pressure--Low	S	R	M	1, 2, 3
e. Differential Pressure Between Steam Lines--High	S	R	M	1, 2, 3
f. Steam Flow in Two Steam Lines--High Coincident with T_{avg}--Low or Steam Line Pressure--Low	S	R	M	1, 2, 3
2. CONTAINMENT SPRAY				
a. Manual Initiation	N.A.	N.A.	M(1)	1, 2, 3, 4
b. Automatic Actuation Logic	N A.	N.A.	M(2)	1, 2, 3, 4
c. Containment Pressure--High High	S	R	M(3)	1, 2, 3

TABLE 3.3-3 (Continued)

b. Above P-11 or P-12, demonstrate that the Minimum Channels OPERABLE requirement is met within 1 hour; operation may continue with the inoperable channel bypassed and one additional channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1.

ACTION 17 - With less than the Minimum Channels OPERABLE, operation may continue provided the containment purge and exhaust valves are maintained closed.

ACTION 18 - With the number of OPERABLE Channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

ACTION 19 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within 1 hour.

b. The Minimum Channels OPERABLE requirements is met; however, one additional channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1.

ENGINEERED SAFETY FEATURES INTERLOCKS

DESIGNATION	CONDITION AND SETPOINT	FUNCTION
P-11	With 2 of 3 pressurizer pressure channels $\geq$ 1915 psig.	P-11 prevents or defeats manual block of safety injection actuation on low pressurizer pressure.
P-12	With 3 of 4 T_{avg} channels $\geq$ 544°F.	P-12 prevents or defeats manual block of safety injection actuation high steam line flow and low steam line pressure.
	With 2 of 4 T_{avg} channels < 540°F.	Allows manual block of safety injection actuation on high steam line flow and low steam line pressure. Causes steam line isolation on high steam flow. Affects steam dump blocks.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA ST., N.W., SUITE 3100
ATLANTA, GEORGIA 30303

Gentlemen:

The enclosed IE Information Notice contains 5 items of information that generally have impact on areas normally under the responsibility of a facility's health physics group. To promote efficiency, these several items have been grouped together and are being given a broad distribution. Consequently, some of the topics may not be applicable to your facility's health physics program. With this multiple-item approach, we believe valuable information and suggested guidance can periodically be provided to licensees. We intend to reserve the traditional "single-item" Information Notice/Circular vehicle for health physics matters requiring more immediate licensee attention. However, we feel the new approach will give NRC a more flexible tool to communicate with licensees on general information related to health physics.

The following provides a brief summary of each item and addresses licensee applicability:

Part 1: Use of Recirculating-Mode (Closed-Circuit) Self-Contained Breathing Apparatus (Rebreathers), provides an upgraded protection factor and upgraded guidelines for use of the BioPak-60P self-contained breathing apparatus-rebreather (SCBA-R). This part is applicable to all licensees who currently possess this device, or are contemplating its purchase.

Part 2: Use of the Chemical "DOP," provides interim guidance in the use of the chemical di-sec. octyl phthalate (DOP), in light of the results of the recent National Cancer Institute/National Toxicology Program carcinogenesis bioassay tests of DOP. This part is applicable to all licensees who use DOP, either in quantitative respirator fit testing, or for high-efficiency particulate air (HEPA) filter testing.

Part 3: Placement of Personnel Monitoring Devices for External Radiation Exposure, describes a situation in which inappropriate placement of personnel monitoring devices resulted in the underestimating of the radiation dose received by workers. This part is applicable to all licensees who may encounter non-uniform fields of radiation.

Part 4: Personnel Entry into Inerted Containment, describes a recent personnel entry into a nitrogen-inerted boiling water reactor (BWR) containment. Although the event described occurred at a BWR, this part provides guidance to help improve worker safety for those licensees

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C.1

whose facilities may have nonradiological airborne hazard areas. This part is applicable to licensees who may have cause to enter toxic or oxygen-deficient atmospheres such as unventilated tanks and voids, or areas affected by oxygen displacement fire suppression systems.

Part 5: Evaluation of Instrument Characteristics When Using Portable Radiation Survey Instruments, provides a discussion of various radiological and nonradiological characteristics that should be considered in the routine calibration and use of portable radiation survey instruments. This part is applicable to all licensees who use portable survey instruments.

The guidance contained in this notice includes those items that the NRC staff believes should be considered. The guidance is not a substitute for NRC regulations and license requirements and, therefore, compliance is not required. No written response to this information notice is required.

If you have any questions related to the provided guidance, please contact this office.

Sincerely,

James P. O'Reilly
Director

Enclosures:
1. IE Information Notice No. 81-26, Part 1: Use of Recirculating-Mode (Closed-Circuit) Self-Contained Breathing Apparatus (Rebreathers)
   Part 2: Use of the Chemical "DOP"
   Part 3: Placement of Personnel Monitoring Devices for External Radiation Exposure
   Part 4: Personnel Entry into Inerted Containment
   Part 5: Evaluation of Instrument Characteristics When Using Portable Radiation Survey Instruments
2. List of Recently Issued IE Information Notices

RII	RII	RII	RII
LJackson:ejw	DPrice	JPStohr	FJLong
8/27/81	8/28/81	8/28/81	8/28/81

SSINS No.: 6835
Accession No.:
8107230026
IN 81-26

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

August 28, 1981

IE INFORMATION NOTICE NO. 81-26: COMPILATION OF HEALTH PHYSICS RELATED INFORMATION ITEMS

Part 1: Use of Recirculating-Mode (Closed-Circuit) Self-Contained Breathing Apparatus (Rebreathers)
Part 2: Use of the Chemical "DOP"
Part 3: Placement of Personnel Monitoring Devices for External Radiation Exposure
Part 4: Personnel Entry into Inerted Containment
Part 5: Evaluation of Instrument Characteristics When Using Portable Radiation Survey Instruments

IE INFORMATION NOTICE NO. 81-26, PART 1: USE OF RECIRCULATING-MODE (CLOSED-CIRCUIT) SELF-CONTAINED BREATHING APPARATUS (REBREATHERS)

Description of Circumstances:

This notice updates information in IE Information Notice No. 80-19 issued on May 6, 1980 that informed licensees of a National Institute for Occupational Safety and Health (NIOSH) "stop-sales-and-recall" order of the BioPak-60P (60P) recirculating-mode (closed-circuit) self-contained breathing apparatus (rebreathers) identified as SCBA-R. It also provides updated guidelines for the use of SCBA-R.

NIOSH rescinded its stop-sales-and-recall order (NIOSH Users Notice of July 11, 1980) after the original problem was satisfactorily resolved. The Los Alamos National Laboratory (LANL) has retested the equipment, as approved since the rescinding of the recall, to assure that recommendations on use are based on the performance of devices tested and certified by NIOSH.

Discussion:

Current regulatory guidance (Regulatory Guide 8.15, "Acceptable Practices for Respiratory Protection") recognizes only a "demand" mode of operation for rebreathers (i.e., a mode in which there is some negative pressure in the facepiece during at least part of the breathing cycle). The protection factor permitted for such devices with full facepieces is 50.

The recently developed 60P rebreather operates in the positive-pressure mode (i.e., pressure in the facepiece remains positive throughout the breathing cycle). This device has been issued NIOSH test and certification number TC-13F-85. Therefore, under the provisions of 10 CFR 20.103 and Regulatory Guide 8.15, Section C, NRC licensees may make allowances for the use of the 60P in estimating exposures of individuals to airborne radioactive materials. However, the NIOSH certification tests do not differentiate this new class of positive-pressure rebreathers from the demand-mode rebreathers, and no quantitative information on efficacy (protection factors) is provided.

Guidance:

The Los Alamos National Laboratory has tested the new devices as part of its ongoing program for NRC. LANL has developed sufficient information for NRC to provide authorization for the use of these rebreathers with an assigned protection factor of 5,000. In addition to the existing regulatory position presented in Regulatory Guide 8.15, the following guidance pertains to the use of positive-pressure rebreathers and should be followed by licensees who use the rebreathers. Some of the discussion deals specifically with the 60P rebreather that, at present, is the only available NIOSH tested-and-certified device of this type.

1. For work in which very high protection factors are required, the positive-pressure (pressure-demand), open-circuit, self-contained breathing apparatus (SCBA) is still the apparatus of choice, unless the advantage of increased working time provided by a positive-pressure rebreather is necessary. The nominal "30-minute" open-circuit SCBA will provide air for only 15 or 20 minutes under fairly heavy working conditions. A recent report presents data indicating that, under very heavy working rates, standard air cylinders can be exhausted in as little as 10 minutes (L. G. Myhre, et al., "Physiological Limits of Firefighters," ESL-TR-79-06, Final Report, Air Force School of Aerospace Medicine, October 1977-January 1979). The 60P, which was tested at LANL under moderate working rates, provided at least a full 60 minutes of service; it also weighs less than most open-circuit SCBA.

   However, all rebreathers have an inherent problem; should contaminants enter the system, such as through a temporary facepiece leak, they would generally circulate through the breathing bags and be breathed repeatedly. Open-circuit devices, on the other hand, clear themselves of contaminants much more quickly because breath is exhaled to atmosphere and clean air is supplied with each inhalation.

2. Perceptible outward leakage of air from SCBA-R at any time is unacceptable because service life will be reduced to only a few minutes. The rebreather makeup air supply comes from a small bottle of oxygen that will be quickly exhausted if the facial seal of the mask is not maintained. Wearers of positive-pressure SCBA-R have to be trained to immediately leave the area where the respirator is required if such outward leakage is detected.

3. It is important that each person who is to use the rebreather be quantitatively fit tested. To the extent that the test hood or chamber will allow, many different body and head movements should be included in these tests to simulate actual work movements while protection factors are measured. A satisfactory fit is provided when a protection factor of at least 5,000 is achieved (no more than 0.02% leakage). These devices, when well-fitted, can provide protection factors of 20,000 or greater. Therefore, a factor of less than 5,000 indicates an unacceptably poor fit for the situations in which such equipment is designed for use. There is also the practical consideration that many licensees use quantitative fit test equipment (e.g., with sodium chloride aerosol) that cannot generally measure protection factors much greater than 5,000.

   The mask supplied with the 60P is manufactured by AGA (Swedish Company) and comes in only one size. It is a relatively wide mask that will stay well sealed to the face for good protection for those users who have wider faces. People with narrow faces, particularly those with narrow and short faces, might be unable to achieve a satisfactory fit (i.e., a fit with a protection factor of at least 5,000).

4. Special training is essential for people who will use rebreathers. The operation of rebreathers is very different from that of open-circuit SCBA with which many workers are familiar. Training should include, in addition to the usual information on the construction and operation of the unit,

hands-on refilling of the carbon-dioxide-removing sorbent and replacement of the oxygen supply bottle (even though maintenance will not be performed by the wearer). Training should also include instruction in the function of the anti-anoxia valve (the wearer will experience difficulty in exhaling as a warning that the oxygen supply is shut off). Trainees should wear the unit while exercising (e.g., jogging, calisthenics, simulated work movements) to learn of any restrictions experienced in breathing or in movement. They should use the unit to end-of-service air supply to become familiar with the behavior of the unit as it runs down and to recognize the end-of-service whistle that sounds for only a brief time. Training should be sufficiently extensive for wearers to be thoroughly familiar with and confident in the use of the apparatus.

5. An anti-fogging solution should be applied to the facepiece lens before each use since there is much more fogging in rebreathers than in open-circuit equipment. Some of the first samples of anti-fogging solution supplied to LANL by Biomarine Industries were defective. Licensees who have purchased this solution should check with the manufacturer about the need for replacement chemicals. Part of the training should prepare wearers to expect more fogging than they have experienced with open-circuit apparatus.

6. The manufacturer of the BioPak-60P has alerted purchasers of the equipment to attach a special accessory hood (the "BioShield") to the 60P when it is used in fire fighting. The hood consists of a flexible "Beta Glass" covering that stretch-fits around the visor and covers the head, facemask, and hoses to the wearer's shoulders. The purpose of the hood is to keep flames or falling embers from igniting combustible materials (such as hair) that might be close to a leak of concentrated oxygen from the equipment (e.g., out of the facepiece). NIOSH certification permits the use of this accessory hood. Licensees who use the 60P for firefighting, or near open flames or falling sparks or embers, should also use this special fire-resistant accessory hood to prevent serious or fatal burns that could result from an oxygen-fed fire.

This IE Information Notice is provided to notify licensees of the authorized use of the BioPak-60P and the interim regulatory positions. When Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," is revised, the revision will reflect NIOSH certification and LANL testing of rebreathers. In the interim, NRC Inspectors will use the specific guidance provided above in addition to the regulatory positions given in Regulatory Guide 8.15 for evaluating the acceptability of licensee respiratory protection programs.

No written response to this information notice is required. If you need additional information with regard to this matter, please contact the appropriate NRC regional office.

IE INFORMATION NOTICE NO. 81-26, PART 2: USE OF THE CHEMICAL "DOP"

Introduction:

This information notice contains preliminary information dealing with the potential toxicity of the chemical di-sec, octyl phthalate (DOP) as shown by animal testing conducted by the National Cancer Institute/National Toxicology Program (NTP). Further guidance will be issued when more defiritive information is developed about DOP and its applications and use.

Background:

DOP, also called di(2-ethylhexyl) phthalate (DEHP), is used in many facilities, including those of some NRC licensees, for quality assurance testing and in-place testing of high-efficiency particulate air (HEPA) filters and for recommended quantitative facepiece fit testing of respirators.

DOP is also a plasticizer commonly added to give flexibility to polymers (e.g., polyvinyl chloride). As such, it is used in natural and synthetic rubbers, lacquers, cellulose compounds, and as a pump fluid for oil-diffusion pumps. Because it is produced and used in very large amounts (almost 400 million pounds in the United States in 1977), exposure of the general population to products containing DOP is widespread. The U.S. Food and Drug Administration (FDA) approved DOP for use in polymers in food-contact items, and it is used in vinyl tubing to transfer blood, intravenous fluids, and milk. DOP has been found in blood stored in vinyl bags and transferred through vinyl tubing (up to 66 mg/l of blood and 250 mg/l in bagged plasma). It has been found in the tissues of patients transfused with blood or blood products stored in flexible polyvinyl chloride containers. DOP has also been found in neo-natal tissues after umbilical catheterization. Children who are given multiple transfusions of blood to treat serious blood diseases might, in a year, receive as much as 1500 mg (about 28 mg/kg) of DOP.

Hazard Assessments:

DOP has, until rerently, been considered to be a substance of low toxicity by all routes of intake. The recommended time-weighted average threshold limit value (TLV) for the work environment that is adopted by the Occupational Safety and Health Administration (OSHA) is 5 mg/m3 in air--the same as that for certain nuisance dusts.

However, the National Cancer Institute/National Toxicology Program recently conducted carcinogenesis bioassay tests on DOP/DEHP. One strain of mouse and one strain of rat in a lifetime feeding study were fed relatively large amounts of DOP (3,000 to 12,000 ppm) in dosed feed. No inhalation study was performed.

A draft NTP report of this study, which has been reviewed and approved with slight changes by the NTP Peer-Review Panel of Experts, finds that DOP is carcinogenic in B6C3F1 mice and in F344 rats (hepatocellular carcinomas in mice and hepatocellular carcinomas and neoplastic nodules in female rats). The report makes no determination of risk to humans.

Current Considerations:

The National Institute for Occupational Safety and Health (NIOSH) has not yet issued final revised new recommendations on the suitability of DOP for various uses. However, on April 30, 1981, NIOSH issued for comment a draft special report on DEHP toxicity. The draft report recommends corn oil as the best alternative from a toxicological viewpoint, for the time being, as a substitute aerosol for quantitative facepiece fitting of respirators. Final recommendations are expected within a few months.

The Los Alamos National Laboratory (LANL) is investigating potential substitutes for DOP (in quantitative fit testing) for both NRC and the Department of Energy (DOE). LANL has successfully used di-2 (ethylhexyl) sebacate (DEHS, "Octoil-S") as a substitute test agent that seems to be of acceptably low toxicity according to current data. The draft NIOSH report also examines the suitability of DEHS as a substitute for DOP in generating quantitative fit test aerosols. The report does not rule out such use of DEHS at this time, but it indicates that more toxicity tests are needed before NIOSH can make a more definitive recommendation on such use of DEHS.

Manufacturers of quantitative fit test equipment have recommended the use of corn oil as an interim substitute test agent for DOP. A satisfactory test aerosol can be generated from corn oil for making the measurements. There may be some disadvantages, however, in odor (described as that of french fries or popcorn) from oxidation of the oil, potential for mold growth on test chamber exit-air filters, and housekeeping problems from the need for more frequent and more difficult cleaning.

Guidance:

A forthcoming final NTP report may find that DOP/DEHP is a weak carcinogen in two strains of mice and rats as indicated by feeding studies. DOP is present in many products in common use, and human exposures to it are widespread. NIOSH and OSHA have not yet had time to fully evaluate and make recommendations on the health significance of exposures to and uses of DOP. Until such information is available, the following interim guidance is suggested for licensees:

1. For quantitative respirator fit testing, even though human exposures are very small during these tests, it would be prudent, at least for now, to discontinue the use of DOP and to substitute an available, less potentially hazardous test agent for these tests. Corn oil, as recommended by the test equipment manufacturers, is acceptable for this use. Licensees should check with manufacturers for detailed instructions on the use of corn oil and on how to avoid or minimize potential problems with odor, mold growth, and cleaning. Di-2 (ethylhexyl) sebacate ("Octoil-S") may also be used if manufacturers deem it compatible with the operation of their equipment.

2. For quality assurance or in-place testing of HEPA filters, DOP may be used where required. However, emissions of DOP from generating and test equipment should be controlled by containment and ventilation to avoid unnecessary exposures of personnel. Exposures of personnel to DOP should be individually assessed and minimized by well-planned work practices. Respiratory protective equipment should be used if necessary.

Several different agencies are continuing to clarify and resolve the questions that arise with respect to the use of DOP. Licensees will be further informed as more definite information is developed about DOP, suitable substitutes, or recommendations on permissible applications and use.

No written response to this information notice is required. If you have any questions regarding this matter, please contact the appropriate NRC Regional Office.

IE INFORMATION NOTICE NO. 81-26, PART 3: PLACEMENT OF PERSONNEL MONITORING DEVICES FOR EXTERNAL RADIATION EXPOSURE

Description of Circumstances:

A recent inspection at a nuclear power plant revealed a situation in which inappropriate placement of personnel monitoring devices resulted in underestimating the radiation dose received by the workers. In this case, the heads and lenses of the workers' eyes were exposed to about 50% more radiation than was measured by their chest-worn film badges and self-reading pocket dosimeters. Such a nonuniform radiation field resulted during repair work in a steam generator when the principal source of radiation came from overhead. Conservative reevaluation by the licensee of the dose received by these individuals revealed that sixty-six workers may have exceeded their 3 rem per calendar quarter exposure limit specificed in 10 CFR 20.101.

On a regular basis, NRC inspectors observe other situations where sufficient attention has not been given to the placement of personnel dosimeters. Many of these involve situations where significant extremity (hand) exposure occurs and extremity dosimeters are not supplied to workers by the licensee. In many cases, the licensee has not made the necessary surveys and/or calculations to adequately evaluate the need to supply extremity dosimeters to the workers. In other cases, the evaluations may have been conducted, but no evaluation records are available.

Discussion:

It is fairly standard practice to wear personnel dosimeters on the trunk, most frequently at the chest or waist position. This is acceptable practice when workers are exposed to relatively uniform fields of radiation. However, it is important to evaluate all nonstandard and unusual situations, particularly where high dose rates are possible, to determine if trunk-worn dosimeters are appropriate. In the majority of the cases, the dose limit of interest is the one that applies to the whole body, head and trunk, active blood-forming organs, lenses of eyes, and gonads. Since the same limit applies to all of these body locations, the potential dose to each should be considered. The objective should be to place the dosimeter in a position where it will measure the highest dose to the areas of interest.

Therefore, if the principal source of radiation is overhead, the dosimeter should probably be placed on the head. If the principal source of radiation is from underfoot, the appropriate location for the dosimeter might be on the lower leg just above the ankle, since long bones of the lower leg contain active blood-forming marrow. If a worker is sitting on or straddling the source of radiation, the dosimeter should be positioned to record the radiation dose to the gonads. If the source of radiation is predominantly behind the workers, the dosimeter should be worn on the back rather than on the front of the body. To be explicit, the dosimeter should be worn at the location of highest entry dose.

The other situation that occurs regularly is significantly higher exposure to the hands, forearms, feet, or ankles. These situations occur most frequently during direct handling or manipulation of radioactive items or while working

from behind a partial shield. In many of these cases, NRC regulations would require wearing dosimeters to record what might be termed the "whole body dose" and dosimeters to record the dose to the extremities.

NRC Regulation 10 CFR 20.202 requires that an appropriate personnel monitoring device be worn if an individual receives or is likely to receive a dose in a calendar quarter in excess of 25% of the values specified in paragraph (a) of 10 CFR 20.101. Thus, a "whole body badge" is required if 300 mrem per quarter is likely to be received by those portions of the body with a limit of 1 25 rem per quarter. In addition, an extremity badge is required if an extremity is likely to receive about 4.7 rem in a quarter. Dosimetry for the only other limit, skin of whole body, is normally accommodated by the beta capability of most personnel dosimeters.

All of the discussions above apply to situations in which the NRC regulations require that dosimeters be worn by radiation workers. There are many cases when an employer may choose to supply dosimeters to workers above and beyond the NRC requirements. This may be done for administrative, information gathering, or other purposes. In some special situations, a worker may be seen wearing several dosimeters. Such conservative safety practices are encouraged.

Some discussion of requirements for radiation surveys and evaluations may be in order. Because 10 CFR Part 20 requires each licensee to supply personnel dosimeters to workers under certain conditions, there is the companion requirement that the licensee make such surveys and evaluations necessary to comply with that requirement. For example, if significant hand exposure is likely to occur and a licensee chooses not to supply extremity dosimeters, the potential dose to the hands must have been evaluated by instrument surveys, calculations, or by other means to support the position that extremity monitoring is not required. Records of such surveys and evaluations must be maintained for inspection.

Guidance:

No written response to this notice is required. Licensees should review their radiation survey and evaluation practices to ensure personnel monioring requirements are met. Special attention should be given to nonuniform radiation fields.

If you require additional information regarding this subject, please contact the appropriate NRC Regional Office.

IE INFORMATION NOTICE NO. 81-26, PART 4: PERSONNEL ENTRY INTO INERTED CONTAINMENT

Introduction:

The information provided below deals with personnel safety issues that are outside the scope of the NRC's nuclear safety requirements; as such no action or response to this information notice is required. However, this information notice provides useful information that will be helpful to licensees in their efforts to maintain safe working conditions for their employees.

Description of Circumstances:

On February 24, 1981, a boiling water reactor (BWR) licensee dispatched three workers, who were fitted with self-contained breathing apparatus (SCBA), into the primary containment (drywell) with the reactor at 30% power and the drywell fully nitrogen-inerted to approximately 3% oxygen by volume. The purpose of this drywell entry was to determine the source of unidentified, primary system leakage into the drywell.

An inerted drywell constitutes an atmosphere immediately dangerous to life and health (IDLH). Personnel safety provisions for the February 24 entry included verbally restricting the areas where the personnel should travel in the containment; providing two other persons with SCBA equipment on standby outside the containment airlock for rescue, if necessary; and preparing for ventilating the containment if a problem arose. The entry lasted 7 minutes and the plant page system was used occasionally to verify the status of the work party. Upon completion of the activity, the work party left the containment with no reported problems. Licensee management reportedly authorized the entry for the purpose of maintaining the plant at power, rather than shutting down.

Discussion:

Had an individual's air supply failed while in the inerted drywell, the planned deinerting in the event of a problem would not have prevented severe personnel injury. Unprotected exposure to an atmosphere containing less than 6% oxygen by volume causes spasmodic breathing, convulsive movements, and death in minutes. In atmosphere with oxygen content in the 8-12% by volume range, unconsciousness can be immediate and without warning upon loss of air supply (SCBA failure). Title 29, Code of Federal Regulations, Part 1910.34 provides certain regulatory requirements for the safe use of respirators in dangerous atmospheres. It states, in part, "Communications (visual, voice or signal line) shall be maintained between both or all individuals present...," e.g., for this situation the working party in the drywell and the rescue party outside the containment airlock. Given the logistics of the situation and available communications equipment, the use of signal line or voice communications was physically impossible. The licensee used the plant pager system intermittently, and thus communications were not maintained on a continual basis. Discussion with the licensee management revealed a lack of awareness of the above-cited Title 29 requirement.

Other airborne-toxic/oxygen-deficient areas can exist at nuclear power plants. Some examples include unventilated tanks or voids; inerted primary components

such as steam generators or portions of primary loop piping; areas affected by oxygen displacement fire suppression systems; confined spaces affected by decaying marine growth, such as circulating water cooling systems; and areas affected by leakage of chlorination systems or accidental mixing of caustic and acid chemicals for makeup water treatment.

Subatmospheric containments can constitute oxygen-deficient areas, to varying degrees, depending on the containment air pressure. At sea level, for example, if the containment air pressure is 11.1 lb/in.2, then the partial pressure of oxygen is approximately 120 mm of mercury; 30 CFR 11 defines an oxygen-deficient atmosphere as "...an atmosphere which contains an oxygen partial pressure of less than 148 millimeters of mercury (19.5 percent by volume at sea level)."

Another potential nonradiological hazard can exist for personnel making BWR drywell entries. In some earlier designed plants, the primary safety valves discharge directly to the drywell atmosphere. In the event of safety valve activation, personnel could be severely injured or killed.

Guidance:

IDLH areas, such as an inerted BWR drywell, should not be entered. In fully inerted areas, assuming SCBA failure, physical incapacitation occurs in seconds and death occurs in minutes. If entry into inerted areas is required under certain extreme emergency conditions and timely deinerting is not possible, then carefully planned and controlled personnel entries can be accomplished.

Even after purging and ventilating, a deinerted area can present a personnel hazard. Pockets of the inerting gas can remain in localized low-lying areas of the space. Before the deinerted area is opened for unrestricted worker access, a thorough sampling inspection should be performed by personnel equipped with SCBA.

Licensees should establish and maintain a nonradiological airborne hazards control program. Basic elements of such a safety program should include the following:

1. Identification of potential hazard areas
2. Quantification of the hazard potential
3. Procedural controls to implement safe work practices commensurate with identified hazards
4. Worker training program

Such a nonradiological hazards control program could be an extension of the licensee's respiratory protection program established to satisfy the requirements of 10 CFR 20.103. NUREG-0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials," contains a summary of the OSHA regulations in the nonradiological airborne hazards area (Chapter 3), and provides a discussion of the evaluation and classification of respiratory hazards (Chapter 4). Another useful reference document for improving worker safety in nonradiological hazards areas is the DHEW (NIOSH) Publication No. 80-106, "Criteria for a Recommended

Standard...Working in Confined Spaces," December, 1979. This document is available for purchase from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

As discussed above, no specific actions or reports are required. If you have any questions regarding this matter, please contact the appropriate NRC Regional Office.

IE INFORMATION NOTICE NO. 81-26, PART 5: EVALUATION OF INSTRUMENT CHARACTERISTICS WHEN USING PORTABLE RADIATION SURVEY INSTRUMENTS

Description of Circumstances:

The Barnwell, South Carolina, radioactive waste burial site recently received a shipment of radioactive waste that exceeded the radiation levels specified by the U.S. Department of Transportation (DOT). The power reactor licensee responsible for the shipment concluded that the error resulted from the use of a portable radiation survey instrument in an orientation other than that for which it was designed. ANSI N323-1978, "Radiation Protection Instrumentation Test and Calibration," defines geotropism as a change in instrument response with a change in instrument orientation as a result of gravitational effects. ANSI N323-1978 discusses this phenomenon as well as other nonradiological and radiological characteristics that should be considered in the routine calibration and use of portable radiation survey instruments.

Strictly speaking, geotropism is the result of gravitational forces or the instrument. Almost invariably, this results from the effects of gravity on the moving parts of conventional meter movements. For example, if an instrument is calibrated in an upright orientation, a change in response may be experienced if the instrument is used on its side with the earth's gravity assisting (or resisting) the movement of the meter needle or other meter movement parts. Additional geotropic effects can also be introduced if instruments are not zeroed in the orientation in which the measurement will be made. Geotropic effects are normally not present in those instruments with digital readouts, since there are no moving meter parts.

Another instrument characteristic that is influenced by orientation is termed "angular dependence." This effect may be observed when a change of instrument response is noted or when there is a change in the direction from which the radiation enters the detector. It is easy to visualize this effect in an instrument with the detector mounted internally but on one side of the instrument case. Thus, a measurement made with the side of the instrument where the detector is located closest to the source may be considerably higher than if the instrument is oriented so the radiation enters from the side farthest from the detector. Some of this effect results from the distance (geometry) effect and some may result from other parts of the instrument between the source and the detector (shielding effect). Even greater shielding effect is observed on most instruments if the radiation enters from the back. Angular dependence may also be observed in instruments with cylindrical detectors, either ionization or GM type. That is, a different response may be obtained when the long axis of the detector is pointed at the source than when it is oriented at right angles to the source.

Guidance:

Improper orientation of radiation survey instruments during calibration or use can cause errors in radiation measurements. All NRC licensees should verify that personnel calibrating or using radiation survey instruments are aware of this phenomenon and that controls are established to ensure that instruments are properly oriented during calibration and use.

No written response to this information notice is required. If you require additional information regarding this matter, contact the appropriate NRC Regional Office.

Attachment:
Recently issued IE Information Notices

Attachment
IN 81-27
August 28, 1981

RECENTLY ISSUED
IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
81-25	Open Equalizing Valve of Differential Pressure Transmitter Causes Reactor Scram and Loss of Redundant Safety Signals.	8/21/81	All power reactor facilities with an OL or CP
81-24	Auxiliary Feed Pump Turbine Bearing Failures	8/5/81	All power reactor facilities with an OL or CP
81-23	Fuel Assembly Damaged due to Improper Positioning of Handling Equipment	8/4/81	All power reactor facilities with an OL or CP
81-22	Section 235 and 236 Amendments to the Atomic Energy Act of 1954	7/31/81	All power research reactor, fuel fabrication and reprocessing, and spent fuel storage licensees and applicants
81-21	Potential Loss of Direct Access to Ultimate Heat Sink	7/21/81	All power reactor facilities with an OL or CP
81-20	Test Failures of Electrical Penetration Assemblies	7/13/81	All power reactor facilities with an OL or CP
81-19	Lost Parts in Primary Coolant System	7/6/81	All power reactor facilities with an OL or CP
81-18	Excessive Radiation Exposures to the Fingers of Three Individuals Incurred During Cleaning and Wipe Testing of Radioactive Sealed Sources at a Sealed-Source Manufacturing Facility	6/23/81	Specified licensees holding byproduct licenses

OL = Operating Licenses
CP = Construction Permits

Distribution for IE Information Notice No. 81-26 (INFORMATION)
August 28, 1981

Addresses	In Reference To
1. Alabama Power Company Attn: R. P. McDonald Vice President-Nuclear Generation Post Office Box 2641 Birmingham, AL 35291	50-348 Farley Unit 1 50-364 Farley Unit 2
2. Allied-General Nuclear Services Attn: J. A. Buckham Acting President P. C. Box 847 Barnwell, SC 29812	50-332
3 Babcock and Wilcox Company ATTN: T. C. Engelder, Director Lynchburg Research Center P. O. Box 1260 Lynchburg, VA 24505	50-13 50-99
4. Babcock and Wilcox Company ATTN: T. C. Engelder, Director Lynchburg Research Center P. O. Box 1260 Lyrchburg, VA 24505	70-824
5. Babcock and Wilcox Company ATTN: R. A. Alto, Manager Virginia Operations, Nuclear Materials and Manufacturing Division Commercial Nuclear Fuel Plant Post Office Box 1260 Lynchburg, VA 24505	70-1201
6. Babcock and Wilcox Company ATTN: J. P. Eckert, Vice President Naval Nuclear Fuel Division Post Office Box 785 Lynchburg, VA 24505	70-27
7. Carolina Power and Light Company Attn: J. A. Jones Executive Vice President and Chief Operating Officer 411 Fayetteville Street Raleigh, NC 27602	50-325 Brunswick Unit 1 50-324 Brunswick Unit 2 50-400 Harris Unit 1 50-401 Harris Unit 2 50-402 Harris Unit 3 50-403 Harris Unit 4 50-261 Robinson Unit 2

Addresses	In Reference To
8. Duke Power Company Attn: L. C. Dail, Vice President Design Engineering P. O. Box 33189 Charlotte, NC 28242	50-491 Cherokee Unit 1 50-492 Cherokee Unit 2 50-493 Cherokee Unit 3 50-488 Perkins Unit 1 50-489 Perkins Unit 2 50-490 Perkins Unit 3
9. Duke Power Company Attn: W. O. Parker, Jr. Vice President, Steam Production P. O. Box 2178 Charlotte, NC 28242	50-369 McGuire Unit 1 50-370 McGuire Unit 2 50-269 Oconee Unit 1 50-270 Oconee Unit 2 50-287 Oconee Unit 3 50-413 Catawba Unit 1 50-414 Catawba Unit 2
10. Florida Power and Light Company Attn: R. E. Uhrig, Vice President Advanced Systems and Technology P. O. Box 529100 Miami, FL 33152	50-335 St. Lucie Unit 1 50-389 St. Lucie Unit 2 50-250 Turkey Point Unit 3 50-251 Turkey Point Unit 4
11. Florida Power Corporation Attn: J. A. Hancock, Assistant Vice President P. O. Box 14042, Mail Stop C-4 St. Petersburg, FL 33733	50-302 Crystal River Unit 3
12. General Electric Company ATTN: J. A. Long, General Manager Wilmington Manufacturing Department Post Office Box 780 Wilmington, NC 28402	70-1113
13. Georgia Institute of Technology ATTN: L. E. Weaver, Director School of Nuclear Engineering 225 North Avenue Atlanta, GA 30332	50-160 50-276
14. Georgia Power Company Attn: J. H. Miller, Jr. Executive Vice President 270 Peachtree Street, N. W. Atlanta, GA 30303	50-321 Hatch Unit 1 50-366 Hatch Unit 2 50-424 Vogtle Unit 1 50-425 Vogtle Unit 2

Addresses — In Reference To

15. Institute of Nuclear Power Operation
Attn: R. W. Pack
Lakeside Complex
1820 Waterplace
Atlanta, GA 30339

16. Memphis State University — 50-538 (AGN-201)
ATTN: D. W. Jones
Center for Nuclear Studies
Memphis, TN 38152

17. Mississippi Power and Light Company — 50-416 Grand Gulf Unit 1 Attn: 50-417 Grand Gulf Unit 2
N. L. Stampley
Vice President of Production
Post Office Box 1640
Jackson, MS 39205

18. North Carolina State University — 50-297, 50-111
ATTN: T. S. Elleman, Head
Department of Nuclear Engineering
Raleigh, NC 27607

19. Nuclear Fuel Services, Inc. — 70-143
ATTN: W. C. Manser, Jr.
General Manager
Erwin, TN 37650

20. Offshore Power Systems — 50-437 FNP 1-8
ATTN: A. R. Collier, President
P. O. Box 8000
Jacksonville, FL 32211

21. South Carolina Electric and Gas Company — 50-395 Summer Unit 1
ATTN: T. C. Nichols, Jr., Vice President
Power Production and System
Operations
P. O. Box 764
Columbia, SC 29218

22. Southern Company Services, Inc.
Attn: O. Batum, Manager
Nuclear Safety & Licensing
Department
P. O. Box 2625
Birmingham, AL 35202

Addresses	In Reference To
29. Virginia Polytechnic Institute and State University ATTN: T. F. Parkinson, Director Nuclear Laboratory Blacksburg, VA 24060	50-124
30. Westinghouse Electric Corporation ATTN: M. D'Amore, Manager Columbia Plant Nuclear Fuel Division Drawer R Columbia, SC 29205	-70-1151
31. West Virginia University College of Engineering ATTN: Reactor Director Morgantown, WV 26505	50-129 (AGN-211)
32. EDS, Nuclear, Inc. ATTN: E. H. Verdery 330 Technology Park/Atlanta Norcross, GA 30092	
33. U. S. Nuclear, Inc. NRC Licensee No. SNM 1315 P. O. Box 680 Oak Ridge, Tennessee 37830	