RECORD #140

TITLE: Guidance on Reporting Doses to Members of the Public From Normal Operations

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MAY 25 1984

NUCLEAR POWER DEPARTMENT
Calvert Cliffs Nuclear Power Plant
Lusby, Maryland 20657

ATTENTION: Mr. P. T. Crinigan
BG&E/Chemistry

Subject: RETS

As a follow up to our discussions on gaseous dose calculations, both at our May 22 meeting and our May 24 Telecon, I am enclosing copies of three NRC memos that clarify and explain our positions.

Original Signed By

Wayne Meinke
Radiological Assessment Branch
(301) 492-9430

Enclosure:
As stated

cc: W. Gammill
C. Willis
F. Congel
D. Jaffe
L. Cunningham

OFFICE	DSI:RAB	DSI:RAB	DSI:METB	D&I			
NAME	WWMeinke:sj	FJCongel	CWillis	DJaffe			
DATE	05/25/84	05/25/84	05/25/84	05/25/84			

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JAN 20 1984

MEMORANDUM FOR: Daniel R. Muller, Assistant Director for Radiation Protection, DSI

FROM: Charles A. Willis, Leader, Effluent Treatment Systems Section, METB, DSI

THRU: William P. Gammill, Chief, METB, DSI

SUBJECT: NOTIFICATION AND REPORTING OF RELEASES OF RADIOACTIVE MATERIALS

As requested, we have reviewed our requirements for notification about, and reporting of, releases of radioactive material from nuclear power plants. The impetus for this review was the apparent uncertainty in coping with the January 1, 1984 release from San Onofre Unit 3. We conclude that the staff position is clearly defined and that this position has been transmitted to the Regional Offices. If further clarification is needed, the appropriate action could be an information notice to the licensees.

The enclosure provides further information and we are prepared to discuss the matter at your convenience. We are also prepared to make a follow-up presentation at a future events briefing as requested by Gary Holahan in his January 13, 1984 memorandum.

The principal problem in this area is the slow progress on updating the radiological effluent technical specifications (RETS) for ORs. Unless something is done to promote cooperation by the licensees, it seems that a number of the ORs will not have approved dose calculation methods in the forseeable future.

Original signed by

Charles A. Willis, Leader
Effluent Treatment Systems Section
Meteorology & Effluent Treatment Branch
Division of Systems Integration

Enclosure:
As Stated

cc: R. Mattson
W. Gammill
F. Congel
L. Cunningham
G. Knighton
G. Holahan

OFFICE	DSI:METB	DSI:METB	DSI:RAB				
SURNAME	CWillis:csp	WGammill	FCongel				
DATE	1/19/84	1/19/84	1/19/84				

2

REQUIREMENTS FOR NOTIFYING THE NRC ABOUT RELEASES OF RADIOACTIVE MATERIALS FROM NUCLEAR POWER PLANTS

Requirements

Requirements for notifying, and for reporting to, the NRC about radioactive releases from NPP are established by the regulations and by the technical specifications. The regulations are:

§ 20.403. Notification:

(a) Immediate: 5000 x MPC averaged over 24 hours

(b) One day: 500 x MPC averaged over 24 hours

§ 20.405. Reports (30 days):

(a) Any release requiring notification

(b) Concentration as much as 10 x limit

(c) Any violation of 40CFR190 (.05 x MPC averaged over 1 year)

§ 50.72. Notification:

(a) Immediate (1 hour)

(1) Emergency plan initiation

(2) Technical specification violation

(b) Four-hour

(1) 2 x MPC averaged over 1 hour

(2) Any event resulting in a news release

(3) Any event resulting in notification of another government agency

Despite our concerted efforts, the requirements of the technical specifications (TS) are not the same for all plants. Generally the TS do not require notification based on releases but the TS do include several reporting requirements. Also the TS include release limits that, in principle, could trigger notification under § 50.72. The TS release limits generally will not precipitate

notification because the TS include "action" requirements that keep releases from constituting TS violations. In some cases (such as San Onofre), where an alarm-level release results in a press release and/or notification of the State Government, § 50.72 requires notification of the NRC within 4 hours.

Generally the TS limits on airborne releases that may lead to notification of the NRC are equivalent to:

(a) noble gas: 1 x MPC instantaneous

(b) iodine and particulates: 1 x MPC over 1 week

Atmospheric Dilution

NRC limits are expressed in terms of concentration or dose but these quantities are not directly observable. Licensees measure releases and meteorological parameters. Doses and concentrations are inferred from these measurements. Usually the dilution provided by the exhaust gas flow is negligible in comparison to atmospheric dilution. Therefore, the downwind concentration is taken as

$$\chi = QF/u.$$

Q is the release rate (Ci/sec), u is wind speed (m/sec) and F is a function of distance and atmospheric stability (m^{-2}). Both F and u are subject to large (2 orders of magnitude) fluctuations in short periods of time.

The instantaneous concentrations are of little practical importance. The radiation doses that result are determined by the integral of the concentrations over time. Most of the relevant limits are for a one year period; for example, 500 mrems in one year. Since the release rates are relatively constant and since changes in release rates usually are independent of meteorological conditions, exposure estimates are based on annual average meteorological dispersion. This quantity differs greatly from one site to another (Figure 1).

Potential Problem From Notification Requirements

Today the technology is available to permit evaluation of offsite concentrations using meteorology that is concurrent with releases. If this were done and the results used as a basis for notification, such notifications would be quite frequent.

To understand the problem, consider that in 1980 the average BWR released noble gases at the rate of about 1.7 mCi/sec. This meets the ALARA criteria (of Appendix I) if the annual average dispersion factor is 1×10^{-5} or less. However, at some such plants, about 5% of the time (400 hours/yr) the dispersion can be expected to be so poor (type F stability with 1 m/sec wind) that the offsite concentration exceeds 2 times the MPC. Thus, if the requirement of 50.72 were interpreted as requiring the use of concurrent meteorology, some plants would be notifying the NRC about releases almost daily even though releases were normal.

The problem is further complicated by the practical limitations on wind speed measurements. At most sites the measured value is zero on the order of 1% of the time (90 hours/year). Whenever the wind speed falls to zero the calculated concentration will exceed twice the MPC unless the radioactivity release rate also is zero. Thus, even a PWR on a large site would be required to notify the NRC about releases frequently, perhaps once or twice per week.

Significance of Notification-Level Concentrations

Even the highest of the notification levels (5000 x MPC averaged over 1 day) is about a factor of 10 below a level at which any health effect (nausea)

might be detected. While every release may be assumed to increase the cancer risk, thousands of releases at this level would be required to produce a discernible increase. Thus the notification levels are not levels at which there is a real concern about public health and safety.

The notification levels were established to call NRC attention to poor radiation control practices by licensees.

Limiting Frequency of Notifications

It is important that the NRC not be notified every time the wind speed drops below the limit of measurement. In fact, notification should be limited to relatively important events. In principle this could be done by keeping concentrations below the MPC levels at the release points, thereby eliminating reliance on atmospheric dilution. In practice, however, this would be quite costly if not completely infeasible. Even for plants with minimal releases (such as Yankee Rowe in 1980) it would be necessary either to reduce releases or to increase airflow if MPC levels were to be reached at the release points.

The practical solution is to permit the use of annual average atmospheric dispersion in assessing compliance with the notification requirements. This approach, in various guises, has been standard for many years and was recently reaffirmed.* The Technical specifications (usually) are clear on this point but the regulations need interpretation. This is expected to hold notification frequency to an acceptable level. The use of annual average atmospheric dispersion permits the use of alarm set-points that do not fluctuate

* L. J. Cunningham, "Inspection Guidance - 50.72," Memorandum to Robert Greger, November 15, 1983.

with the wind. It also avoids over-reliance on complex computer systems and permits reactor operation at constant power through changing weather conditions.

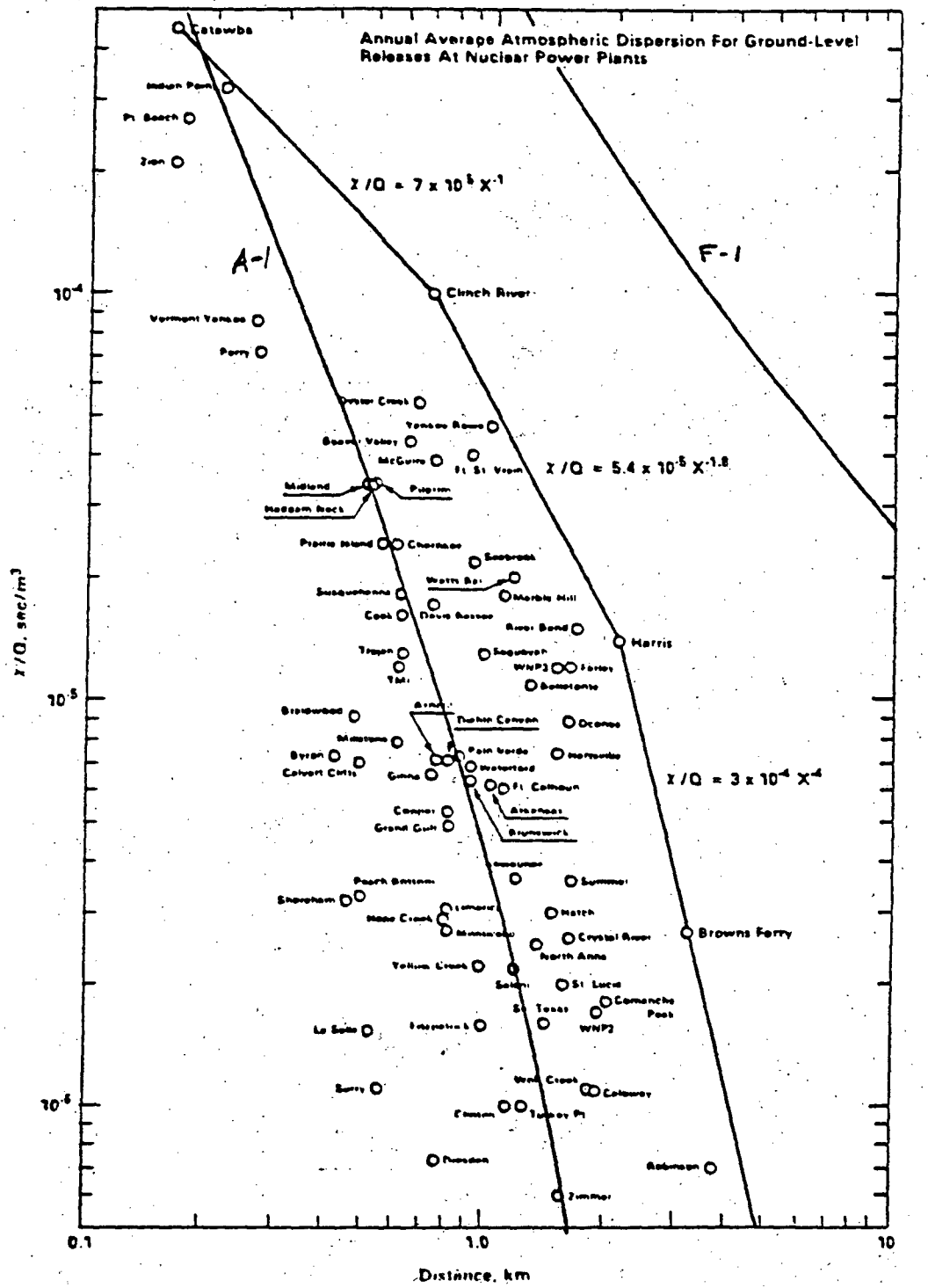
The use of annual average atmospheric dispersion is intended as an option for the licensee. In some situations the use of "real time" dispersion may be desirable. For example, the NRC does not object if a licensee wants to empty a waste gas tank relatively rapidly at a time when the wind will carry the radioactive gas out to sea or when dispersion conditions are good.

Dose Calculation Methodology

The methods for calculating doses are well established by regulatory guides and topical reports. Further, the NRC has recently published a textbook on radiological assessment that compiles this information in a single document and that provides additional clarification.

Many of the NPP licensees have established their own dose calculation methods in NRC-approved documents called "offsite dose calculation manuals." When the current effort to update the radiological effluent technical specifications (RETS) for ORs is complete, all NPP licensees will have approved dose calculation methods.

The most significant remaining problem in this area is the slow progress on RETS. About half the ORs do not yet have approved dose calculation methods. Current indications are that about a quarter of the ORs will not have approved methods in the forseeable future.


Annual Average Atmospheric Dispersion For Ground-Level Releases At Nuclear Power Plants
χ/Q = 7 x 10⁻⁶ X⁻¹
A-1
F-1
χ/Q = 5.4 x 10⁻⁵ X⁻¹·⁸
χ/Q = 3 x 10⁻⁴ X⁻⁴
Catawba
Clinch River
Harris
Browns Ferry
Zimmer
10⁻⁴
10⁻⁵
10⁻⁶
0.1
1.0
10
χ/Q, sec/m³
Distance, km

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 15 1983

MEMORANDUM FOR: Robert Greger, Section Chief
Emergency Preparedness & Radiological
Safety Branch
Region III

FROM: LeMoine J. Cunningham, Section Chief
Section 2, Operating Reactor Programs Branch
Division of Quality Assurance, Safeguards,
and Inspection Programs, IE

SUBJECT: INSPECTION GUIDANCE - 50.72

On October 20, 1983, Paul Lovendale requested clarification of several aspects of the new 50.72 notification requirements. The questions related to the requirement that licensees call in notification of radioactive releases that exceed the specified concentrations. Specifically, the questions were: 1) what meteorological data should be used in determining offsite concentrations? (e.g., annual average, real time or worse case?) and 2) what location should be used? (e.g., unrestricted area as defined by Part 20 or the expanded definition as specified in NUREG-0133?).

In addition, you noted that the revised 50.72 was incorporated into the 10 CFR by Supplement No. 12 issued September 20, 1983, although the rule change is not effective until January 1, 1984. You note that a currently effective version is not in the 10 CFR.

Inspection guidance for operating nuclear power reactors concerning 50.72 is as follows:

1. Annual average meteorological data should be used for determining offsite airborne concentrations of radioactivity. This is to maintain consistency with the tech specs.

2. The expanded definition of an unrestricted area as specified in NUREG-0133 should be used. This is to maintain consistency with the tech specs.

3. The lack of a currently effective version of 50.72 in the 10 CFR loose-leaf version is an administrative problem only. Licensees and inspectors should keep the old pages for reference until January 1, 1984. The old version is still the effective rule until January and deviation from those requirements in favor of the new requirements would be a technical violation. However, in such a case, notation in the inspection report without further enforcement action would be the appropriate approach.

Appropriate NRR, Admin, ELD and IE representatives were consulted during the formulation of this guidance.

LeMoine J. Cunningham, Section Chief
Section 2, Operating Reactor Programs Branch
Division of Quality Assurance, Safeguards,
and Inspection Programs, IE

cc: J. Partlow, IE
E. Jordan, IE
W. Fisher, IE
E. Flack, IE
F. Congel, NRR
R. Bellamy, RI
A. Gibson, RII
C. Paperiello, RIII
R. Hall, RIV
F. Wenslawski, RV
P. F. McKee, IE

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MAR 10 1983

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Licensing, DL.

and

Gus C. Lainas, Assistant Director
for Operating Reactors, DL

FROM: Daniel R. Muller, Assistant Director
for Radiation Protection, DSI

SUBJECT: GUIDANCE ON REPORTING DOSES TO MEMBERS OF THE PUBLIC FROM NORMAL OPERATIONS

The standard radiological effluent technical specifications (RETS) require the reporting of radiation doses to members of the public (in addition to reporting radioactivity releases and meteorological measurements). A few licensees will be reporting doses for the 1982 calendar year. Generally, plants licensed since 1979 and operating reactors with recently updated RETS have requirements for reporting doses; see Enclosure 1.

Inquiries from licensees indicate that guidance is needed on the reporting of doses to members of the public. Regulatory Guide 1.21 addresses the issue but is inadequate because it is not explicit and because it implies that the reports should provide more information immediately. Interim guidance (Enclosure 2) was developed to meet this immediate need.

It is requested that, as soon as practicable, the interim guidance be transmitted to the licensees for plants listed in Enclosure 1. This guidance should be of value to other licensees and applicants as well.

Original signed by
Daniel R. Muller

Daniel R. Muller, Assistant Director
for Radiation Protection
Division of Systems Integration

Enclosures:
As stated

cc: R. Mattson
W. Gammill
F. Congel
C. Willis

*SEE PREVIOUS WHITE FOR CONCURRENCES

OFFICE	DSI:RP:METB	DSI:RP:METB	DSI:RP:RAB	DSI:RP			
SURNAME	CAWillis:dj*	WPGammill*	FJCongel*	DRMuller			
DATE	02/15/83	02/16/83	03/03/83	03/10/83			

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Enclosure 1

PLANTS WITH TECHNICAL SPECIFICATIONS REQUIRING REPORTING OF OFF-SITE DOSES FOR 1982

Diablo Canyon 1

Farley 1/2

Grand Gulf 1

LaSalle 1

McGuire 1

San Onofre 2/3

Sequoyah 1/2

Susquehanna 1

Summer 1

Three Mile Island 1

Enclosure 2

INTERIM GUIDANCE ON REPORTING OFF-SITE RADIATION DOSES FROM NORMAL OPERATION OF NUCLEAR POWER PLANTS

Purpose

Off-site radiation doses from normal operation of some nuclear power plants must be reported annually to satisfy the requirements of the technical specifications. The reports are intended to demonstrate compliance with (1) the dose design objectives of 10CFR50 Appendix I, and (2) the requirements of 40CFR190. The purpose of this document is to provide guidance on the reports to simplify reporting, assure that minimum requirements are met, and provide consistency in reports from different licensees.

Criteria

The dose design objectives of 10CFR50 Appendix I are met if

1. the dose or dose commitment to a member of the public from radioactive materials in liquid effluents from each reactor do not exceed:
   a. during any calendar quarter, 1.5 mrem to the total body or 5 mrem to any organ, or
   b. during any calendar year, 3 mrem to the total body or 10 mrem to any organ;
2. the air dose due to noble gases in gaseous effluents from each reactor do not exceed:
   a. during any calendar quarter, 5 mrad from gamma radiation or 10 mrad from beta radiation, or
   b. during any calendar year, 10 mrad from gamma radiation or 20 mrad from beta radiation; and

3. the dose to a member of the public from radioiodines and particulates in gaseous effluents from each reactor do not exceed:
   a. 7.5 mrem to any organ during any calendar quarter, or
   b. 15 mrem to any organ during any calendar year.

The requirements of 40CFR190 are met if the dose or dose commitment to any member of the public from uranium fuel cycle sources in a calendar year does not exceed

1. 75 mrem to the thyroid, or
2. 25 mrem to any other organ or to the total body.

The 40CFR190 requirements differ in significant ways from the Appendix I criteria. Specifically, for 40CFR190 purposes, consideration must include the following (as well as doses from effluents):

1. Direct radiation doses
2. Doses from other fuel cycle facilities*, including other reactors.

The term "members of the public" includes all persons who are not occupationally associated with the plant. The term does not include employees of the utility, its contractors, or vendors. Also excluded are people who enter the site to inspect, service equipment, or make deliveries. This term does include people who use portions of the site for recreational, occupational, or other purposes not associated with the nuclear plant.

*Fuel cycle facilities are uranium mills, conversion plants, enrichment plants, fabrication facilities, power reactors, reprocessing plants, and waste disposal sites.

"Direct radiation" is radiation which reaches unrestricted areas even though its source is retained within the plant. Examples are gamma rays from the decay of nitrogen-16 in BWR turbine buildings and gamma rays from low level radioactive wastes stored on site. Direct radiation dose is not addressed in Appendix I, but is limited by 40CFR190.

Report Content

The purpose of the annual report is to summarize the calculations performed during the year to show compliance with Appendix I and with 49CFR190 related tech specs. Consequently, only the maximum calculated doses to individuals need to be reported. Appendix I dose design objectives are stated both for calendar quarters and for years; thus, both should be reported. Appendix I states criteria for 3 categories of effluents (liquid, airborne iodines and particulates, and airborne noble gases); the doses should be reported accordingly. The information should be presented as indicated in Table 1.

Where doses reported in Table 1 exceed the Appendix I criteria, an explanation should be provided.

Compliance with the 40CFR190 dose limits must be addressed explicitly. If the doses reported in Table 1 clearly are below the 40CFR190 limits, all that needs to be added are statements addressing doses from other fuel cycle facilities. In most cases, this requirement is satisfied by statements that there are no other fuel cycle facilities within 8 km.

Plant Name _____
Year _____

Table 1

MAXIMUM* OFF-SITE DOSES AND DOSE COMMITMENTS TO MEMBERS OF THE PUBLIC

Source	Dose***, Millirems				
	1st Q	2nd Q	3rd Q	4th Q	Year**
Liquid Effluents	(1	(5	(9	(13	(17
Airborne Effluents					
Iodines & Particulates	(2	(6	(10	(14	(18
Noble Gases	(3	(7	(11	(15	(19
Direct Radiation	(4	(8	(12	(16	(20

Based on meteorology data provided in _____

*"Maximum" means the largest fraction of the corresponding Appendix I dose design objective.

**"Maximum" dose for the year may not equal the sum of the quarterly maximum doses because the doses may be to different organs or may occur at different places.

***The numbered footnotes briefly explain how each maximum dose was calculated, including the organ and the predominant pathway(s).

Example of Numbered Footnote:

1. Total body dose, primarily by fish pathway. Calculated using the reported activity and dilution volume with the assumptions of Regulatory Guide 1.111.