

ENCLOSURE 4

OFFSITE DOSE CALCULATION MANUAL  
FOR THE HADDAM NECK PLANT ISFSI, REVISION 25

DEC 11 2014

# **OFF-SITE DOSE CALCULATION MANUAL (ODCM)**

**For The  
HADDAM NECK ISFSI**

**Docket No. 50-213**

**HADDAM NECK ISFSI**  
**OFFSITE DOSE CALCULATION MANUAL (ODCM)**

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## **A. INTRODUCTION**

The purpose of this document is to provide a method for demonstrating compliance with the dose limits for MEMBERS OF THE PUBLIC and contains the guidance for submittal of the annual reports required by 10 CFR 50. In addition, the document provides the locations and type of monitoring required for the Radiological Environmental Monitoring Program (REMP).

In accordance with the requirements of 10 CFR 72.104(a) and 40 CFR 190.10(a), the dose to a MEMBER OF THE PUBLIC for radioactive material in effluents and direct radiation from an Independent Spent Fuel Storage Installation (ISFSI) is limited to 25 mrem/yr to the whole body, 75 mrem/yr to the thyroid and 25 mrem/yr to any other critical organ as a result of exposure to planned discharges of radioactive materials to the environment, direct radiation from the ISFSI and any other radiation from uranium fuel cycle operations within the region.

Under normal operations, experience has shown that the ISFSI will be operated at a small fraction of the above dose limits. This is primarily due to the design of the Independent Spent Fuel Storage Installation, which prevents the release of radioactive materials in liquid and particulate form and there are no other uranium fuel cycle operations within 5 miles of the Haddam Neck Plant (HNP) site. Therefore, the dose equations from Regulatory Guide 1.109, Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I are not necessary for inclusion in the ODCM. The remaining dose component to be considered is from direct radiation. 10 CFR 72.104(a) and 40 CFR 190.10(a) establish this dose limit as 25 mrem/yr for MEMBERS OF THE PUBLIC. Figure 1 shows the site boundary lines for the site and the location of the ISFSI.

## **B. DEFINITIONS**

### **B.1 Member(s) of the Public**

MEMBER(S) OF THE PUBLIC (for the purposes of 10 CFR 50, Appendix I) shall include all persons who are not occupationally associated with the site. This category does not include employees of the utility, its contractors, or vendors. Also excluded from this category, are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the site operations or decommissioning of the plant.

### **B.2 Offsite Dose Calculation Manual (ODCM)**

The ODCM contains the methodology and parameters used in the calculation of off-site doses in the conduct of the Radiological Environmental Monitoring Program. The ODCM also contains (1) the Radiological Environmental Monitoring Programs required by the Connecticut Yankee Quality Assurance Program (QAP) and (2) descriptions of the information that should be included in the Annual Radiological Environmental Operation and Annual Radioactive Effluent Release Reports.

### **B.3 Property Boundary, Site Boundary and Controlled Area**

The Property Boundary is that line beyond which land is not owned, leased or otherwise controlled by Connecticut Yankee Atomic Power Company (CYAPCO).

The Site Boundary is defined as the boundary for the area governed by the HNP 10 CFR 50 License as defined in the NRC Safety Evaluation Report dated November 26, 2007.

The Controlled Area is an area at least 300 meters from the Protected Area Boundary, access to which can be limited by the licensee.

The Controlled Area will be utilized as the boundary for the establishing of dose to MEMBERS OF THE PUBLIC. 10 CFR 72.104(a) establishes the annual dose limits that must be met at the Controlled Area boundary during normal operations and anticipated occurrences. Realistic occupancy factors shall be applied at these locations for the purposes of dose calculations. 40 CFR 190.10(a) establishes doses that must be met for normal operations.

The Property Boundary, Site Boundary, Controlled Area, and Protected Area Boundary are depicted on Figure 1.

### **C. RESPONSIBILITIES**

All changes to this manual shall be independently reviewed and approved by the ISFSI Manager or Designee prior to implementation.

It is the responsibility of the ISFSI Manager or Designee to ensure compliance with all the requirements of this manual.

### **D. RADIOLOGICAL ENVIRONMENTAL MONITORING**

The Radiological Environmental Monitoring Program (REMP) for the ISFSI monitors for direct radiation exposure only.

The type and number of radiological environmental monitoring stations including collection and analysis frequencies are shown in Appendix A.

#### **D.1 Dose/Dose Rate Controls and Calculations**

By design, there are no liquid or gaseous effluents associated with the operation of the ISFSI. With the completion of site remediation activities that required periodic dewatering of construction excavations, along with the removal of all systems or operations that generated, contained or processed waste gas or airborne particulates, there are no longer any gaseous or liquid effluent releases from site operations. Therefore, requirements for control, sampling, analyzing, monitoring or dose impact assessment for radioactive liquids or gases are not needed.

##### **D.1.1 Total Dose**

###### **Control D.1.1**

The dose or dose commitment to any real MEMBER OF THE PUBLIC from all site sources is limited to less than or equal to 25 mrem to the total body or any organ (except the thyroid, which is limited to less than or equal to 75 mrem) over a calendar year.

### Applicability

At all times.

### ACTION

With the calculated or projected dose from direct radiation contributions from the Independent Spent Fuel Storage Installation (ISFSI) determined to be, or projected to be, above the annual (calendar) limits of Control D.1.1, prepare and submit to the commission within 30 days, pursuant to 10 CFR 50.4, a Special Report that defines the corrective action to be taken to reduce subsequent exceedences to prevent recurrence of exceeding the above limits and include the schedule for achieving conformance with the above limits. The Special Report shall include an analysis that estimates the radiation exposure (dose) to a member of the public from site sources for the calendar year covered by the report. It also shall describe levels of radiation and concentrations of radioactive material, if any, involved and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the exposure condition resulting in violation of 40 CFR 190.10(a) has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR 190.11. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

## D.2 SURVEILLANCE REQUIREMENTS

### SR D.2.1

Dose calculations - Cumulative dose contributions from direct radiation shall be determined semi-annually in accordance with Section D.1.1.

### Bases

Control D.1.1 is provided to meet the dose limitations of 40 CFR 190.10(a) that have been incorporated into 10 CFR 20 by 46FR18525. The control requires the preparation and submittal of a Special Report whenever the calculated or projected doses from the site exceed the dose limits of 40 CFR 190.10(a). The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR 190.10(a) limits. For the purposes of the Special Report, it may be assumed that the dose commitment to a MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR 190.10(a), the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR 190.10(a) have not already been corrected), in accordance with the provisions of 40 CFR 190.11 until NRC staff action is completed. The variance only relates to the limits of 40 CFR 190.10(a) and does not apply in any

way to the other requirements for dose limitation of 10 CFR 20 or 10 CFR 72.104(a).

### **D.3     Method to Calculate Direct Dose from ISFSI Operations**

Control D.1.1 restricts the dose to the whole body and any organ of any real MEMBERS OF THE PUBLIC at and beyond the Controlled Area Boundary from all site sources (including direct radiation) to the limit of 25 mrem in a year, except for the thyroid which is limited to 75 mrem in a year.

Estimates of direct exposure above background in areas at and beyond the Controlled Area Boundary can be determined from measurements made by environmental TLDs that are part of the Environmental Monitoring Program. A net response is determined by subtracting the average TLD value of the control station from the TLD measurement at each monitoring location. Realistic occupancy factors are then applied to the net exposure value. A positive net exposure is assumed if the net value is greater than the propagated uncertainty of the TLD indicator and control measurements. Alternatively, direct dose calculations from identified fixed sources on-site can be used to estimate the off-site direct dose contribution where TLD information may not be applicable.

## **E.     LAND USE CENSUS**

The land use census ensures that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR 50.

Due to the current status of the Haddam Neck Site, the Land Use Census is not expected to change in a manner that would affect the Environmental Monitoring Program. The most recent census shall be in effect until superseded. During the course of the ISFSI Operation, an updated Land Use Census can be obtained at any time as directed by the ISFSI Management.

## **F.     REPORTS**

### **F.1     Annual Radiological Environmental Operating Report**

The Annual Radiological Environmental Operating Report shall include summaries, interpretations and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with the previous environmental surveillance reports and an assessment of the observed impacts of the ISFSI on the environment. The report shall also include the results of the land use census required by Section E of this manual if necessary. If levels of radioactivity are detected that result in calculated doses greater than 10 CFR 50 Appendix I Guidelines, the report shall provide an analysis of the cause and a planned course of action to alleviate the cause.

The report shall include a summary table of all radiological environmental samples, which shall include the following information for each pathway sampled, and each type of analysis:

- a. Total number of analyses performed at indicator locations;
- b. Total number of analyses performed at control locations;
- c. Mean and range of all indicator locations together;
- d. Mean and average of all control locations together;
- e. Name, distance and direction from discharge, mean and range for the location with the highest annual mean (indicator or control); and
- f. Number of nonroutine reported measurements as defined in these specifications.

In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. If available, the missing data shall be submitted in the next annual report.

The report shall also include a map of sampling locations keyed to a table giving distances and directions from the ISFSI.

## **F.2 Annual Radioactive Effluent Report**

The Annual Radioactive Effluent Report (ARER) shall include quarterly quantities of and an annual summary of radioactive liquid and gaseous effluents released from the unit in the Regulatory Guide 1.21 (Rev 1, 06/74) format. Radiation dose assessments for these effluents shall be provided in accordance with 10 CFR 50.36a and the ODCM. An annual assessment of the radiation dose from the site to the most likely exposed MEMBER OF THE PUBLIC shall be included to demonstrate conformance with 10 CFR 72.104(a) and 40 CFR 190.10(a). An evaluation of the direct dose aspect will be discussed in the Annual Environmental Operating Report. This evaluation will include the dose recorded on control TLDs and TLDs located near residents. The ARER shall be submitted by May 1 of each year for the period covering the previous calendar year.

The ARER shall include a summary of each type of solid radioactive waste shipped offsite for burial or final disposal during the report period and shall include the following information for each type:

- a. Type of waste (e.g., spent resin, compacted dry waste, irradiated components, etc.);
- b. Solidification agent (e.g., cement);
- c. Total curies;
- d. Total volume and typical container volumes;
- e. Principal radionuclides (those greater than 10% of total activity); and
- f. Types of containers used (e.g., LSA, Type A, etc.).

The ARER shall include the following information for each abnormal release of radioactive material from the site to unrestricted areas:

- a. Description of the events and equipment involved;
- b. Causes for the abnormal release;
- c. Actions taken to prevent recurrence; and
- d. Consequences of the abnormal release.



Changes to the OFFSITE DOSE CALCULATION MANUAL (ODCM) shall be submitted to the NRC as appropriate, as part of or concurrent with the ARER for the period in which the changes were made.

**F.3 Special Reports**

Special reports shall be submitted, as required per Section D.1.1, to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555, with a copy to the appropriate Regional Office of the NRC, within the time period specified for each report.

**G. REFERENCES**

- G.1 Regulatory Guide 1.109, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with [10 CFR 50], Appendix I," U.S. Nuclear Regulatory Commission, Revision 1, October 1977
- G.2 Connecticut Yankee Atomic Power Company Quality Assurance Program
- G.3 Letter from K. I. McConnell (NRC) to W. A. Norton (CYAPCO), "Haddam Neck Plant Release of Land from Part 50 License," dated November 26, 2007
- G.4 10 CFR 72.104, Criteria for radioactive materials in effluents and direct radiation from an ISFSI or MRS
- G.5 40 CFR 190.10, Standards for normal operations
- G.6 40 CFR 190.11, Variances for unusual operations

## **APPENDIX A**

### **ENVIRONMENTAL MONITORING PROGRAM<sup>1</sup>**

#### **Environmental Monitoring Locations**

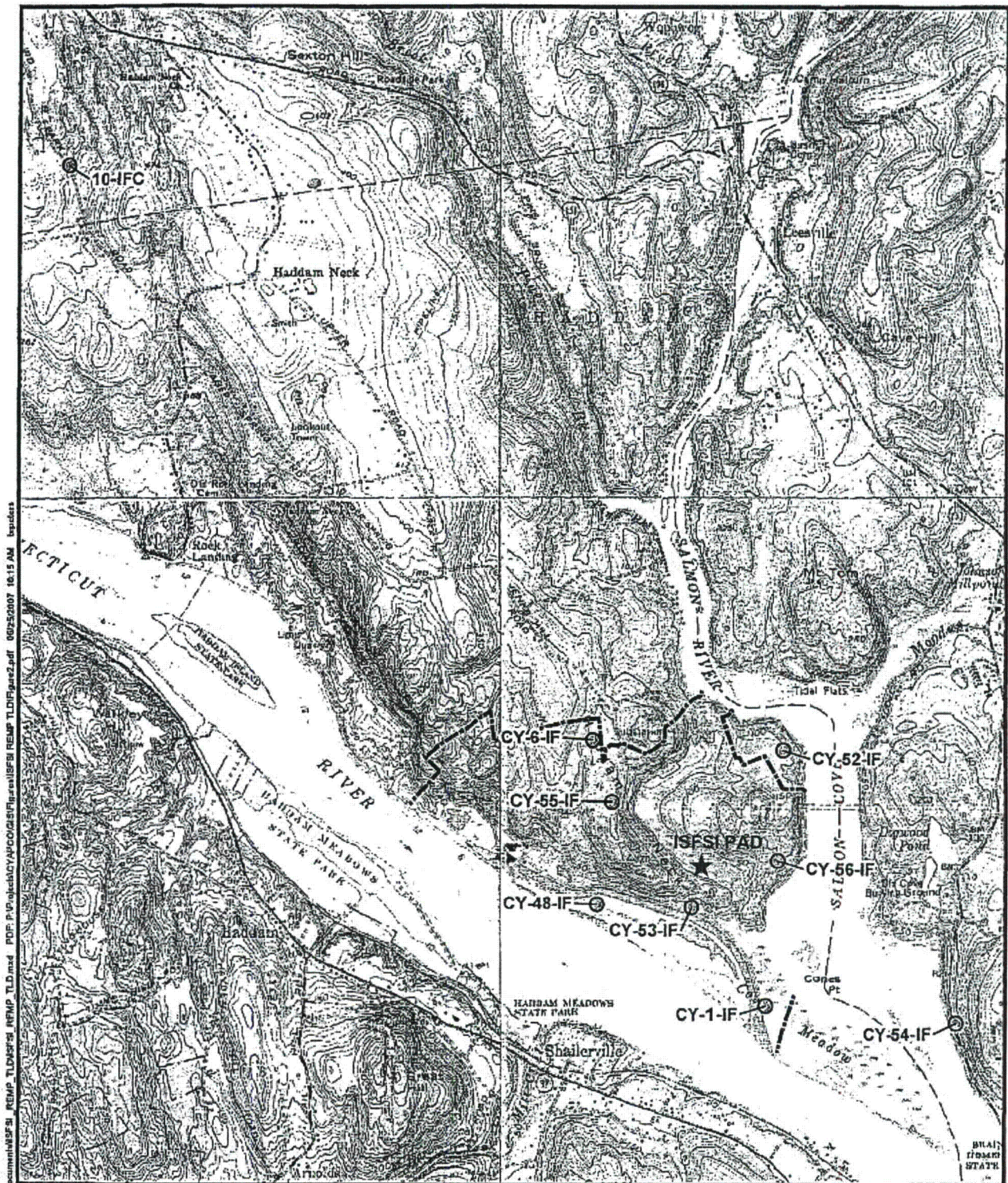
The following lists the frequency and locations of environmental TLD sampling.

<b>Exposure Pathway and/or Sample</b>	<b>Number of Locations</b>	<b>Frequency</b>	<b>Type and Frequency of Analysis</b>
1. Gamma Dose – Environmental TLD	8	Semi-Annual	Gamma Dose – Semi-Annual

<b>Number</b>	<b>Location Name</b>	<b>Direction &amp; Distance From Source*</b>	<b>Sample Types</b>
1-IF	At Mouth of Historical Discharge Canal	0.5 Mi, SSE IF	TLD
6-IF	Substation	0.6 Mi, NW IF	TLD
48-IF	Near Historical Met Tower Shack	0.4 Mi, WSW	TLD
53-IF	ISFSI Haul Route	0.2 Mi, SSW	TLD
54-IF	Route 149 Near Mouth of Salmon River	1.0 Mi, ESE	TLD
55-IF	High Voltage Tower - NW of ISFSI Pad	0.4 Mi, NW	TLD
56-IF	Near Historical Borrow Pit	0.2 Mi, E	TLD
10-IFC	Hurd Park Road	2.8 Mi, NNW	TLD, 2 TLDs each semi-annual period
IFC = ISFSI Control Indicator      IF= ISFSI Indicator			
* The ISFSI Pad is the Source.			

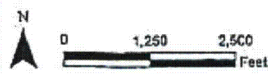






Legend

- ISFSI REMP TLD Locations
- Approximate Property Outline



Prepared by BRP Checked by NSG

Figure 2

ISFSI REMP TLD Locations

CYAPCO, Haddam Neck Plant  
Haddam, Connecticut  
MACTEC, Inc.