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Met-Ed GPU

Metropolitan Edison Company
Post Office Box 480
Middletown, Pennsylvania 17057
717 944-4041

Writer's Direct Dial Number

March 21, 1980
TLL 123

TMI Support
Attention: J. T. Collins
Deputy Director
U.S. Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057

Dear Sir:

Three Mile Island Nuclear Station, Unit II (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Reactor Building Entry

This letter is to document the Reactor Building entry program and to request your approval to proceed with the entry as soon as possible. The requested entry would occur prior to purging the building atmosphere.

In order to proceed with cleanup of the TMI-2 Reactor Building, working access to the building must be established. Over the past several months, we have studied the environment, completed dose assessments, and developed plans to enter the Reactor Building with or without cleanup of the building atmosphere. We have determined that Reactor Building entry should be made at this time in order to gather data necessary for the completion of cleanup planning.

The results of our studies and the final plan developed for entry are contained in the attached report. The procedure for the Reactor Building entry has previously been furnished to you for review, comment and approval.

The request for entry prior to purging is being made to avoid any further delays in the planning for containment cleanup. This material has been presented to your staff in meetings on February 20, 1980 and March 12 and 13, 1980. We are ready to meet with you to review again, if necessary, the entry program presented in the attached report.

Very truly yours,

/s/ R. F. Wilson

R. F. Wilson
Director, TMI-II

RFW:gp
Enclosures
cc: R. Vollmer

INITIAL

REACTOR BUILDING

ENTRY

PROGRAM

INTRODUCTION

In order to complete decontamination and defueling of Three Mile Island Unit 2, entry into the Reactor Building is necessary. This report presents the program for that entry including the specific needs for Reactor Building entry, assessment of the containment environment, dose evaluations, personnel preparation, equipment to be used, and a step-by-step entry description.

CONCLUSIONS

1. Metropolitan Edison has concluded that Reactor Building entry should be made without further delay and prior to purging the Reactor Building atmosphere.

2. The entry program can be completed with approximately 1 rad planned total dose accumulation per entry team member. Termination of the entry activity within 20 minutes or when either member has received 625 mrem whole body dose will assure that neither the 3 rem quarterly dose limit nor the sixty minute breathing air supply limit is reached.

3. Adequate planning has been completed to assure that all risks to entry team members is low through proper training, equipment selection, preliminary dose assessments, personal dosimetry selection, and entry route selection.

4. The benefits of entry prior to purging the Reactor Building atmosphere in order to gather necessary data sooner far outweigh any reduction in allowable entry time that is imposed as a result of the presence of some airborne radioactivity.

5. Off-site dose to the public as a result of Reactor Building entry is less than 0.014 mRads skin dose and 0.00032 mRads whole body dose.

NEED FOR REACTOR BUILDING ENTRY

The unknown core confirguration poses a small but incalculable risk which should be dealt with in a timely manner. In order to resolve this risk, decontamination of the reactor and removal of the fuel is essential. It is necessary that technical data be acquired from inside the Three Mile Island Unit 2 Reactor Building as soon as reasonably possible for the purpose of planning the decontamination of the Three Mile Island Unit 2 Reactor Building. To properly plan the decontamination of the Reactor Building, radiological surveys, including isotopic analysis and radiological mapping to identify hot spots, are required. In addition, a determination of the need for a remote decontamination system for general area and hot spot decontamination is required. In order to accomplish the above tasks, a radiological assessment of the status of the various areas of the building is required. The information gathered by a manned entry into the Reactor Building is essential in providing the necessary technical information to the engineering personnel for properly evaluating the alternative methods for decontamination and recovery. This information is fundamental in developing the plan for cleanup. Presently there is no available data from direct measurements, on the radiological environment at the 305' elevation in the Reactor Building. There is no radiation map of the interior of the Reactor Building other than theoretical extrapolations based on minimal information; information that is insufficient to provide a firm determination of the radiological environment inside the Reactor Building.

An assessment of the status of the integrity of the Reactor Building, the nuclear steam supply system (NSSS) and other equipment inside the Reactor Building is required. This assessment will provide a firm determination of the condition of the various systems and equipment inside the Reactor Building and will aid in assuring that the available technical resources are applied in the areas of the greatest technical need.

An assessment of the functional capability of the various plant components vital in maintaining the integrity of the Reactor Building and reactor systems is necessary, since the possibility of the failure or malfunction of equipment increases as time passes without preventive maintenance.

A determination of the ability or inability of personnel to make future entries into the Reactor Building to correct potential plant casualty conditions and gather additional technical data to support the planning for decontamination and assessment of damage is required.

In order to accomplish the objectives outlined above, several entries into the Reactor Building should be made. The first entry is primarily to: 1) Gather real dose and dose rate information required to allow proper Health Physics planning of subsequent entries. 2) Provide a survey of the 305' elevation. 3) Establish the ability to enter the Reactor Building. The second entry is primarily to: 1) Provide a survey of the 347' elevation. 2) Provide a survey of the reactor head area, to facilitate defueling planning. Subsequent entries would be made as deemed necessary to improve knowledge of radiological conditions in the Reactor Building.

The Three Mile Island Unit 2 Reactor Building should be entered as soon as possible. Any delay in entry into the Unit 2 Reactor Building will result in insufficient technical data for decontamination planning and will lengthen the schedule for recovering the unit due to the lack of sufficient technical information required to properly plan and execute the recovery operation. Any delays in entering the TMI-2 Reactor Building will also result in delays in our ability to cope with any plant or equipment casualty inside the TMI-2 Reactor Building. Entry into the Reactor Building by man will determine the ability of Metropolitan Edison to cope with working in the present environment. It is vital that we enter the Reactor Building as soon as possible in order to ensure the safety, health and well being of the public and plant personnel and to restore the unit to its safest possible condition.

REACTOR BUILDING ASSESSMENT

In order to plan the reentry into the Reactor Building, Metropolitan Edison set up a Containment Assessment Task Force in May 1979. The overall goal and objective of the Containment Assessment Task Force was to establish, using external measurements, the environment inside the Reactor Building. The specific function of the Assessment Task Force was to gather data as necessary to ensure that containment atmosphere cleanup could be accomplished, that an initial entry into the building could be accomplished, and that planning for Reactor Building decontamination and recovery could proceed.

In order to support a containment entry, the Containment Assessment Task Force established a number of experiments and measurements which could be run without benefit of building entry. These experiments were designed to determine as much as possible the airborne contamination, contamination plated out on the various surfaces of the containment, and contamination contained in the water in the basement of the Reactor Building. The experiments and measurements were specifically designed to obtain detailed technical data as much as possible on the magnitude, identity, distribution, and chemical forms of the existing airborne, surface, and sump water activity and the resulting radiation levels.

The measurements and experiments taken as part of this assessment program included the following:

1. Weekly containment building airborne samples. These samples were analyzed for particulates, gases, iodine, gross beta, and strontium.

2. Gamma radiation readings through the equipment hatch, using a Ge(Li) detector. The purpose of these measurements was to determine the isotopic identity and magnitude of plateout on the 305' elevation.

3. Gamma radiation readings through the inner flange of penetration R605 (approximately 2 feet above the sump water level, near the basement of the Reactor Building) using a Ge(Li) detector and a teletector. The purpose of this measurement was to determine sump level and specific activity of the contamination in the sump.

4. A sump water sample. In order to perform this sampling, a hole was cut in the inner flange of penetration R401 (approximately 2 feet above the sump water level) and water was drawn into a sample bomb for analysis. The water was sent to Oak Ridge in order to accomplish a detailed activity analysis of the water. Subsequently, several larger samples were drawn for futher analysis.

5. Gamma radiation readings through the inner metal flange of penetration R626 (at the 347' elevation approximately 11 feet above the Reactor Building operating floor) using a NaI(Tl) detector and teletector. The purpose of this measurement was to determine general area radiation levels and to determine the isotopic identity and magnitude of plateout on the 347' elevation operating floor.

6. Radiation mapping of the number 2 personnel air lock. The experiment consisted of taking air samples from the personnel air lock and also placing probes into the air lock to determine airborne activity radiation level inside the air lock.

7. Analysis of the hydrogen recombiner inlet spool piece. This experiment consisted of removal of the spool piece to the recombiner and shipment of the spool piece to Oak Ridge for analysis. The purpose of the experiment was to determine what plateout existed on the spool piece as a result of the several days of flow through the hydrogen recombiner which occurred within the first three weeks after the accident. Analysis results have not been obtained.

8. Remote TV camera and radiation surveys through penetration R626. The purpose of this experiment was to obtain an initial visual assessment of the damage that may have been done by the accident and to obtain the first <u>direct</u> radiation measurement readings inside the building.

9. Air lock entry. This experiment consisted of opening the outer door and entering the air lock in order to take detailed swipe surveys, radiation surveys and Ge(Li) scans through the inner door of the air lock. The purpose of this experiment was to obtain better information on the 305' elevation radiation levels and the 305' elevation plateout source. The experiment was also expected to afford some view through the inner door viewport of the 305' elevation. Final analysis of the results of this experiment has not been completed.

In addition to the above experiments, additional experiments have been performed to determine the shielding capability of the proposed suit material to be worn by the Reactor Building entry team members. The completion of the above experiments has enabled us to determine the environment inside the Reactor Building and has aided us in the selection of protective clothing and equipment to support entry into the building with or without the building being purged.

The results of the above experiments provide a solid baseline for evaluating the environment inside the Unit 2 Reactor Building. This baseline information provides the basis for calculating general area and hot spot activity inside the Reactor Building and allows for a determination of dose to personnel entering the Reactor Building.

DOSE AND DOSE RATES

Using the information gained by the Containment Assessment Task Force, conservative calculations of Reactor Building dose rates have been made. Whole body dose rates and skin dose rates for the Reactor Building general areas are shown on Tables 1 and 2, respectively. Hot spots expected are shown in Bechtel Drawing SK-C-15. Total whole body dose that would be received during the initial Reactor Building entry is shown in Tables 3, 4, 5, and 6. Table 6 shows that the dose received by the entry team will be well within the allowable quarterly dose limit of 3 rem in one quarter.

Since the Reactor Building atmosphere has not been cleaned up, some Krypton will be released from the air lock during building exit. Maximum possible release, release rate, and off-site dose have been calculated and are shown in Table 7. The calculation assumes that the air lock goes into equilibrium with the Reactor Building atmosphere while the entry is being made and that all the Krypton in the air lock is discharged during exit. The releases that occur as a result of the entry are well within allowable Technical Specification and 10CFR release rates and doses.

Dose assessments are based on a twenty minute planned entry schedule.

PERSONNEL

The initial entry will be conducted by two engineers. There will also be a backup team of two men waiting just outside the airlock. All these men have undergone physiological exams, psychological exams, and fitness evaluations by doctors at the Hershey Medical Center and have been found medically fit to conduct the entry.

The four entry team personnel have undergone a thorough training program to prepare for the entry. This training program is outlined in Table 8.

The entry and backup teams will be dressed in protective clothing and will carry a self-contained breathing apparatus. Protective clothing will include long underwear (for personal comfort), a pressurized, air/water tight Viking dry suit (for beta attenuation), and plastic rain gear (to mitigate direct contamination). The primary respiratory equipment will be a Bio-Marine Bio-Pack 60 oxygen supplement/ CO_2 scrubbing system rated for sixty minutes use. A secondary oxygen bottle supply rated for about seven minuts will also be carried.

EQUIPMENT

The entry team will also carry communications equipment, radiation monitoring instruments, dosimetry, lights, tools, and a camera.

Each entry team member will carry a 5 watt walkie-talkie with two channels and two frequencies per channel. The entry team will use cranial transmitters and ear receivers to communicate with a 75 watt transmitter/receiver base station just outside the ante room. Antennae will be provided in penetration R626 and on the glass window of the outer airlock door.

Gamma and beta radiation will be measured using teletector (gamma) and Radector-3 (beta/gamma) instruments.

Total dose will be recorded by self-reading digital dosimeters, telemetered dosimeters, TLD's, and film badges. The telemetered dosimeters will transmit total dose received to the communications base station, where it can be reviewed by command center personnel. The digital dosimeters provide a continuous readout of total dose to entry team members. TLD's and film badges will be placed at multiple locations on the body and on extremities.

Two miners lights will be worn by each entry team member. One entry team member will also carry a beacon light. An additional beacon light will be left in the area of the air lock.

ENTRY PLAN

The entry team will enter personnel air lock number 2 and conduct a survey of the 305' elevation. The survey plan is shown in Table 9.

The entry will be terminated when either entry team member has received 625 mrem whole body dose of when twenty minutes have elapsed. The dose and time limits were selected to provide ample conservatism to ensure that neither the 3 rem quarterly dose limit nor the sixty minute breathing air supply limit is reached.

WHOLE BODY DOSE RATES*

	WITHOUT PURGE OF RB	WITH PURGE OF RB
° 305' Elevation		
- Krypton	.900	---
- Plateout	.2	.2
- Sump Water	1.500	1.5
	2.6 Rad/hr	1.7 Rad/hr
° 347' Elevation		
- Krypton	1.2	---
- Plateout	.4	.4
	1.6 Rad/hr	.4 Rad/hr
° Stair Numbers 1 and 2		
- Krypton	1.15	---
- Plateout	.2	.2
- Sump Water	9.0	9.0
	10.35 Rad/hr	9.2 Rad/hr
° Airlock (During Exit)		
- Krypton	0.941 Rad/hr	0 Rad/hr
° Ante Room (During Exit)		
- Krypton	0.101 Rad/hr	0 Rad/hr

* General Area Only; Dose Not Include Hot Spots

Table 1

BETA SKIN DOSE RATES*

	WITHOUT PURGE OF RB	WITH PURGE OF RB
° 305' Elevation		
- Krypton	9.0	0
- Plateout	1.0	1.0
	10.0 Rad/hr	1.0 Rad/hr
° 347' Elevation		
- Krypton	9.0	0
- Plateout	1.5	1.5
	10.5 Rad/hr	1.5 Rad/hr
° Stair Numbers 1 and 2		
- Krypton	9.0	0
- Plateout	1.0	1.0
	10.0 Rad/hr	1.0 Rad/hr

*General Area Only; Does Not Include Hot Spots

Table 2

ENTRY TEAM DOSE ASSESSMENT

305' ELEVATION

	Direct Gamma Dose Rate (mR/hr)	Bremsstrahlung Dose Rate (mR/hr)	Dose Rate (mR/hr)	Time (Minutes)	Dose (Rads)
Krypton	100	800	900	20.0	.300
Plateout	150	50	200	20.0	.067
Sump Water	1500	---	1500	20.0	.500
Hot Spots			3390	2	.113
Total Dose					.980

Table 3

ENTRY TEAM DOSE ASSESSMENT

AIRLOCK

	Direct Gamma Dose Rate (mR/hr)	Bremsstrahlung Dose Rate (mR/hr)	Total Dose Rate (mR/hr)	Time (Minutes)	Dose (Rads)
Krypton	182	759	941	1	.016
Plateout					0
Sump Water					0
Hot Spots					0
Total Dose					.016

Table 4

ANTE ROOM PERSONNEL DOSE ASSESSMENT

	Krypton* Dose Rate (mR/hr)	Time (Minutes)	Dose (Rads)
Member A	101	10	.017
Member B	101	10	.017
HP 1	101	10	.017
HP 2	101	10	.017
HP 3	101	10	.017
		Total Person-Rem	0.085

*Based on 23.8 curies in ante room which give maximum Krypton concentration of 5.89×10^{-2} µCi/ml.

Table 5

ENTRY TEAM TOTAL DOSE

	Dose (Rads)
305' Elevation	.980
Airlock	.016
Anteroom	.017
Total	1.013

Table 6

OFF-SITE EXPOSURE

23.8 Curies Krypton release possible

Release takes place over 155 minutes

Maximum Krypton release rate of 22241 μCi/sc

Maximum skin dose* = 0.014 mrads

Maximum whole body dose* = 0.00032 mrads

*Reg. Guide 1.24 Calculation Method Using Average Meteorology.

Table 7

TRAINING PROGRAM

40 Hrs Classroom

40 Hrs Hands On

1 Candidate Knowledge Evaluation

2. Radiation Effects/Risk/Limits

3 Radiation Interaction with Matter and Detection Theory

4 Theory and use of Radiation Dosimetry and Bioassy

5 Task Plan - Work Definition

5a General Scope of Plan/Tour Unit 1

- (1) General Objectives of Entry
- (2) Reactor Building Model Familiarization
- (3) Unit 1 Containment Familiarization Tour
- (4) Debrief with Model

5b Radiation Data

- (1) Expected Radiation Sources Defined on a Map Related to Entry Route
- (2) Anticipated Nuclides
- (3) Anticipated Biological Effects From the Nuclides
- (4) Anticipated Types of Radiation Hazard
  - (a) Point
  - (b) Line
  - (c) Submerged
- (5) Review of TV Tapes From 626 Penetration

5c Casualty Consideration

- (1) Basic Casualty Consideration
  - (a) Communication
  - (b) Lighting
  - (c) Protective Clothing

Table 8

(d) Installed Containment Equipment

(e) Radiological

(2) Response to Casualties Listed Above

5d Task Priorities/Difficulties Sequence

(1) List Each Task with its Priority

(2) Define Each Task with the Problems Associated with Task

(3) Establish Task Sequence

6 Physiological Consideration

7 Use of Radiation Instrumentation

8 Task Procedure Review Workshop

9 Breathing Apparatus Familiarization

Other Equipment Familiarization

Hands on Equipment Familiarization

Review/Critique

10 Auxiliary Building Tour /Briefing (Use Currently Existing Protective Clothing, Stress ALARA Considerations in a Radiological Environment)

11 Protective Clothing/Communication

(Communiction Equipment and Breathing Apparatus Must be Available)

12 (1) Task Walk Through - No Equipment

(2) Task Walk Through Critique

13 (1) Task Walk Through No Lights with Communication Equipment

(2) Task Walk Through Critique

14 Physiological Briefing

15 Casuality Review Walk Through

16 Time-Motion Task Discipline Classroom Exercise

17 Task Walk Through Real Time - Unit 1, No Lights with Communicator and Skeleton Command Post

Critique Walk Through

Task Walk Through Real Time - Unit 1, No Lights with Communication and Skeleton Command Post

18 Casualty Drills Real Time - Dark with Communication and Skeleton Command Post

Critique

Casualty Drills Real Time - Dark with Communication and Skeleton Command Post

19 Radiation Data Update/Review 626 Penetration TV Tapes

20 Suit/Communication Familiarization Classroom Dress/Undress Casualties

21 Readiness Evaluation Critique - Refresher Planning

22 Final Rehearsal Real Time - Dark Communication

23 Operational Turnover

24 Initial Entry Debrief

MANAGEMENT BRIEFING

M1 Command/Support Familiarization

M2 Command/Support Procedures Review

M3 Command/Support Walk Through Exercise

TIME	TEAM MEMBER A	TEAM MEMBER B	COMMAND CENTER CC
0 Min.	In Airlock	In Airlock	Continuously monitor activities and evaluate dose to entrants. Record data. Direct entrants.
1 Min.	Teletector Survey/Enter Transit to Red	Open Door B-γ Survey/Enter	
2 Min. 30 Sec.	Teletector Survey/Place Light (Verify Communications 3 Min.)	Close Door (Verify Communications)	
4 Min.	Survey Area Around Red 360^o		
	Survey Swipe Locations	Swipe A Swipe B	
6 Min.	(Verify Communications 6 Min.) Extend Toward Location Orange and Swipe D	(Verify Communications 6 Min.) Swipe C	
	Move to Location Orange	Swipe D	
8 Min. 30 Sec.	360^o Teletector at Orange (Verify Communications 9 Min.) Return to Red	360^o B-γ at Orange (Verify Communications 9 Min.) Pictures a, b, c, d (180^o) From Orange Return to Red Pictures e, f, g, h	
9 Min. 30 Sec.	Transit to Yellow	Transit to Yellow	
	180^o Teletector (Mu Line, Covered Hatch, Stairwell) As Making Transit	Open Stairwell Door	
	Teletector Into Stairwell	B-γ at Stairwell Door	
	(Verify Communications 12 Min.)	(Verify Communications 12 Min.)	

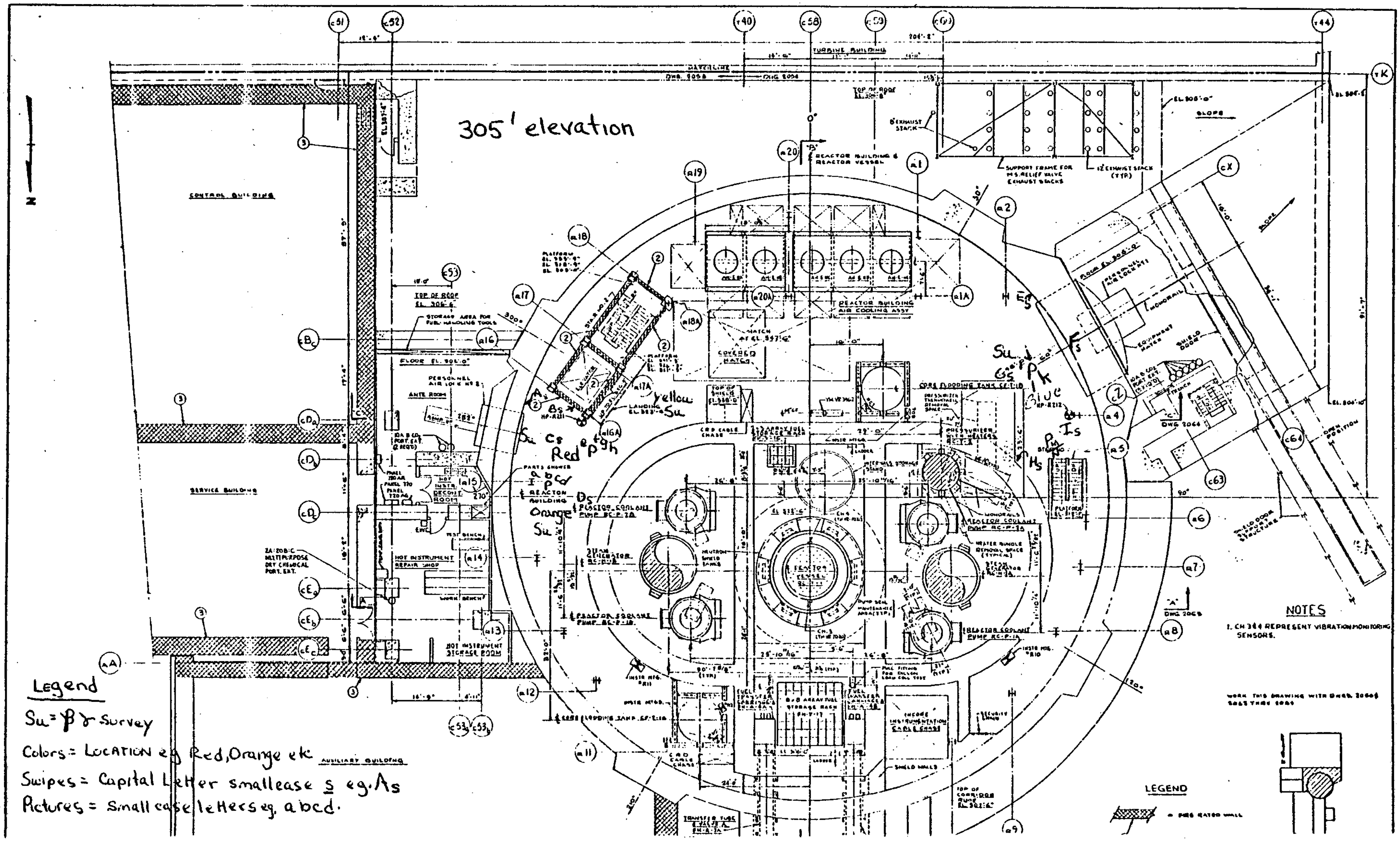
Table 9

TIME	TEAM MEMBER A	TEAM MEMBER B	COMMAND CENTER CC
13 Min. 30 Sec.	Teletector to/and Over Covered Hatch and Air Coolers	B- γ at Covered Hatch	Evaluate Ability to Transit to Blue
	USE ALTERNATE PLAN IF UNABLE TO TRANS TO BLUE		
14 Min. 15 Sec.	Transit to Blue (Verify Communications 15 Min.)	Transit to Blue (Verify Communications 15 Min.)	
16 Min. 45 Sec.	360^{o} Survey with Teletector (Including Into Stairwell)	360^{o} Survey Swipe E, F, G Pictures i, j, k, l Swipe H, I Pictures m, n	
18 Min.	Return to Red and Exit Building	Return to Red and Exit Building	
19 Min. 15 Sec.	Enter Air Lock	Enter Air Lock Pick Up Light at Red	
20 Min. 15 Sec.	Exit Air Lock	Exit Air Lock	
30 Min. 15 Sec.	Exit Ante Room	Exit Ante Room	

ALTERNATE PLAN - THE ALTERNATE PLAN IS TO SURVEY THE AREA NORTH OF STATION ORANGE TOWARD CORE FLOOD TANK 1A TO GET AS COMPLETE A SURVEY AS IS PERMISSABLE WITHIN THE ALLOWABLE STAY TIME AND DOSE.

INITIAL Entry PLAN

Sh 1



Legend

Su = βγ Survey

Colors = LOCATION eg Red, Orange etc

Swipes = Capital Letter smallcase s eg. As

Pictures = Small case letters eg. abcd.

TMI - II BCC LIST

Mrs. Pat Higgins
Edison Electric Institute
1111 19th Street, NW
Washington, D.C. 20036

Mr. E. L. Blake, Jr.
Shaw, Pittman, Potts & Trowbridge
1800 "M" Street, NW
Washington, D.C. 20036

Mr. R. Sanacore
American Nuclear Insurers
The Exchange - Suite 245
270 Farmington Avenue
Farmington, CT 06032

G. Hovey - TMI-Trl. 105
P. Clark-GPUSC Parsippany
R. Fenti - QA - TMI Trl. 22
J. J. Barton - TMI Trl. 102
L. W. Harding - TMI Licensing
R. M. Klingaman - Met-Ed Reading
N. Kazanas - Parsippany - QA
J. F. Wilson - TMI Trl. 14
J. G. Herbein - TMI Trl. 118
B. Ballard - TMI Trl 16
G. P. Miller - TMI-I
R. C. Arnold - TMI Trl. 201
D. G. Mitchell - Met-Ed Reading
C. A. Nixdorf - TMI - Admin. Bldg.
B. Elam - TMI Trl. 104
L. L. Lawyer - TMI Trl. 118
J. Chwastyk - TMI-II Ops.
S. D. Chaplin - TMI Licensing

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Mr. George Kulynych
Babcock & Wilcox
P.O. Box 1260
Lynchburg, VA 24505

Mr. T. F. Hartley, Jr.
Marsh & McLennan, Inc.
1221 Avenue of the Americas
New York, New York 10020

Mr. A. S. Dam
Burns & Roe, Inc.
650 Winters Avenue
Paramus, New Jersey 07652

Ms. Margaret Reilly
Chief Div. of Reactor Review
Pa. Dept. of Environmental Resources
Fulton Bank Building
Harrisburg, Pa. 17120

Dr. Steve Long, Director
Power Plant Siting Program
Department of Natural Resources
Tawes State Office, Bldg. B-3
580 Taylor Avenue
Annapolis, MD 21401

J. Langenbach - GPUSC Parsip
E. D. Fuller - GPUSC Parsip
J. C. DeVine - TMI Trl. 110
R. W. Heward - TMI Trl. 180
W. N. Moreau - TMI Trl. 109
J. T. Collins - NRC Trl. 1
E. G. Wallace - Parsippany
W. F. Schmauss - TMI-II GRC Chairman-Parsippany
D. H. Reppert - TMI GORB Secretary-Parsippany
C. E. Hartman - TMI-I PORC Chairman - TMI-I
M. A. Shatto - TMI-I PORC Secretary - TMI-I
G. A. Kunder - TMI-II PORC Chairman - TMI-II
D. C. Carl - TMI-II PORC Secretary - TMI-II
B. A. Hockley - Discovery Room - Crawford Station
J. Thiesing - Bechtel, Gaithersburg
R. L. Rider - Bechtel - TMI Trl. 107A
M Murrell - GPUSC Parsip