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January 14, 1980  
TLL 020

TMI Support  
Attn: John T. Collins, Deputy Director  
U. S. Nuclear Regulatory Commission  
c/o Three Mile Island Nuclear Station  
Middletown, Pennsylvania 17057

Dear Sir:

Three Mile Island Nuclear Station, Unit II (TMI-2)  
Operating License No. DPR-73  
Docket No. 50-320  
TMI-II Radiation Protection Plan

The Radiation Protection Plan for Three Mile Island Nuclear Station, Unit II is herewith forwarded. This plan is transmitted for your final approval. NRC comments on Revision 0 (dated December 7, 1979), as discussed in the meeting between TMI-II and NRC personnel on December 21, 1979, have been resolved.

The TMI-II Radiation Protection Plan sets forth the radiation protection policies and philosophies of the Metropolitan Edison Company and the General Public Utilities Corporation radiological controls program. It is intended that this plan will be the first chapter of the TMI-II Radiological Controls Procedures Manual (RCPM). The RCPM will consist of revisions of procedures which existed in the previous HPP 1600 and 1700 series, supplemented as necessary with additional procedures deemed necessary to comply with the TMI-II Radiation Protection Plan.

Sincerely,

R. C. Arnold  
Senior Vice President  
Metropolitan Edison Company

RCA:LJL:hah

cc: R. H. Vollmer

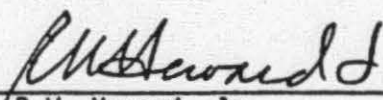
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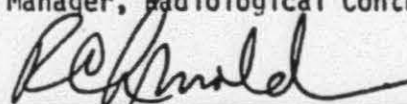
Approved  
5/1/11

THREE MILE ISLAND NUCLEAR STATION

UNIT 2  
RADIATION PROTECTION PLAN

  
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Manager, Radiological Controls

12-7-79

  
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Senior Vice President, Met-Ed

12-7-79

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Changes to this document require approval by these positions.

X 8001 240 447

## REVISIONS

REV.	DATE	REVISION	MANAGER RADIOLOGICAL CONTROLS	SENIOR VICE PRESIDENT MET-ED
1	01-14-80	Incorporated "NRC comments on TMI- Unit 2 R.P.P. Rev. 0 12/07/79" and other Internal Comments	<i>Howard</i> 1-14-80	<i>Rehman</i> 1-14-80

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THREE MILE ISLAND NUCLEAR STATION

UNIT 2

RADIATION PROTECTION PLAN

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Article 1 - Foundation for the TMI-2 Radiological Controls Program

This document, the Three Mile Island Unit 2 Radiation Protection Plan, sets forth the philosophies, basic policies and objectives of Metropolitan Edison Company and General Public Utilities Corporation concerning their TMI-2 Radiological Controls Program. The objective of the radiological controls program is to control radiation hazards to avoid accidental radiation exposures, to maintain exposures within the regulatory requirements, and also to maintain exposures to workers and the general population as low as is reasonably achievable. These philosophies, policies, and objectives are based on and stem from the regulations of the Nuclear Regulatory Commission (NRC) as contained in Title 10 of the Code of Federal Regulations, Parts 19, 20, 50, and 71, and appropriate Regulatory Guides, specifically 8.8 Rev. 3 (1978), 8.10 Rev. 1-R (1975), 8.13 Rev. 1 (1975), and 8.15 (1976). The TMI-2 Radiation Protection Plan is based on these references, therefore they are not repeated throughout the remainder of this document.

Specific details as to how the TMI-2 Radiation Protection Plan is implemented shall be promulgated in the TMI-2 Radiological Controls Procedures Manual (RCPM) and shall include those applicable procedures addressed in Reg. Guide 1.33 Rev. 2(1978), App. A, paragraph 7, and paragraph 8(aa), (bb); further references to the TMI-2 RCPM are not repeated throughout this document. The TMI-2 RCPM will consist of revisions to procedures which existed in the previous HPP 1600 and 1700 series, applicable Administrative procedures, and additional procedures deemed necessary. This TMI-2 Radiation Protection Plan is the first part of the TMI-2 RCPM. Requirements governing release of radioactive liquids and gases to the environment and the disposal of



solid radioactive waste are not addressed in this TMI-2 Radiation Protection Plan, but are addressed in the Environmental Technical Specifications.

Verbatim compliance with the TMI-2 RCPM is mandatory. In the event a procedure cannot be followed exactly, work under that procedure shall be stopped and shall not commence again until the procedure has been corrected.

This TMI-2 Radiation Protection Plan and the new TMI-2 RCPM are being written primarily because of the unique radiological situation existing at TMI Unit 2. Thus, the procedures have direct applicability only to TMI Unit 2 and apply to Unit 1 only insofar as they are specifically made applicable. Procedures shall provide adequate guidance and specify appropriate methods or techniques to insure that the performance of each activity is in accordance with sound radiological control principles, and is in compliance with applicable regulatory provisions. The RCPM shall be prepared, reviewed, approved, and controlled as described in the RCPM Administrative procedures.

The TMI-2 Radiological Controls Program is to be fully integrated into each and every phase of the recovery effort at TMI Unit 2. The accident which occurred at TMI Unit 2 has created an environment of radiological conditions unique to the nuclear power industry. The TMI-2 Radiological Controls Program when carried out as specified will assure that the recovery of Unit 2 even under these unique conditions will be completed with personnel who work at the site incurring radiation exposure as low as can reasonably be achieved.

In order to meet this objective, the program must be carried out by each person involved in the TMI-2 activities. There is no group, or person involved in the TMI-2 recovery who does not have some

degree of responsibility for the Radiological Controls Program. Failure of any person to recognize this responsibility or to comply with issued procedures will not be tolerated. A radiologically safe recovery operation will be achieved if each individual carries out his or her responsibility.

The performance of each manager and supervisor must demonstrate support for the commitment by top management of General Public Utilities Corporation and Metropolitan Edison Company to a strong, effective radiological controls program.



## Article 2 - Responsibilities of Workers

Although personnel specially trained in radiological controls normally oversee radioactive work, each individual involved in this work must constantly remain aware of the potential radiological problems. Each individual is responsible for maintaining his or her exposure as low as reasonably achievable. Each individual's actions directly affect his exposure, contamination, and overall radiological problems associated with the work. The following rules shall be followed by individuals to minimize radiological problems:

1. Obey promptly "stop-work" and "evacuate" orders of radiological control personnel.
2. Obey posted, oral and written radiological control instructions and procedures, including instructions on Radiation Work Permits.
3. Wear TLD and self reading dosimeter where required by signs or by radiological control personnel. Report loss or unexpected exposure and offscale dosimeter to Radiological Control Department.
4. Keep track of personal radiation exposure status and avoid exceeding exposure limits.
5. Remain in as low a radiation area as practicable to accomplish work.
6. Do not loiter in radiation areas.
7. Do not smoke, eat, or chew in contaminated areas.
8. Wear anticontamination clothing and respiratory protection properly and wherever required by signs or radiological control personnel.
9. Remove anticontamination clothing and respiratory protection properly to minimize spread of contamination.



10. Frisk or be frisked for contamination when leaving a contaminated area or a radiological control point. Notify Radiological Controls personnel if contamination is found.
11. For a known or possible radioactive spill, minimize its spread and notify radiological control personnel promptly.
12. Do not unnecessarily touch a contaminated surface or allow clothing, tools, or other equipment to do so.
13. Place contaminated tools, equipment and solid waste on disposable surfaces (for example, sheet plastic) when not in use and inside plastic bags when work is finished.
14. Limit the amount of material that has to be decontaminated or disposed of as radioactive waste.
15. Notify Radiological Controls personnel of faulty or alarming radiation protection equipment.
16. Report the presence of open wounds to radiological control and medical personnel prior to work in areas where radioactive contamination exists and immediately if a wound occurs while in such an area.
17. Notify dosimetry personnel upon returning to the site after medical administration of radiopharmaceuticals.
18. Assure a mentally alert and physically sound condition for performing assigned work.
19. Ensure that your activities do not create radiological problems for others and be alert for the possibilities that the activities of others may change the radiological conditions to which you are exposed.

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Article 3 - Audits, Reviews and Reports on the TMI-2 Radiological Controls Program

As indicated in Article 2, each individual is responsible for maintaining his or her radiation exposure as low as reasonably achievable while completing the scope of work they are required to perform. Each will be required to comply with the applicable procedures of the TMI-2 RCPM and the specific radiological controls prescribed for work in which they are engaged.

In order to ensure that these requirements are being met and to assist all site personnel in understanding and complying with these requirements, the following audit and review procedures shall be used:

1. Radiological control technicians shall monitor and aid the performance of each individual insofar as radiological work practices are concerned.
2. The radiological technical support staff shall review on a regular basis the performance of the radiological control technicians. This review includes shift coverage on those jobs which are considered likely to have a high potential for radiological difficulties.
3. Radiological assessments shall be conducted throughout the Radiological Controls Program on a continuous basis. This assessment function shall report directly to the highest level of management in the TMI-2 organization and shall be outside the Radiological Controls Department. A written report of the findings of this assessment shall be prepared and issued every 2 weeks.



4. Quality Assurance audits shall be conducted of the TMI-2 Radiological Controls Program by technically qualified persons from outside the Radiological Controls Department. These audits will be conducted in accordance with procedures as outlined in the TMI-2 Recovery Quality Assurance Plan. The Quality Assurance Methods, Operations and Audit group will schedule these audits and will provide personnel from their own department and/or outside contractors as appropriate to conduct the audits. These audits shall cover the applicable portions of the Quality Assurance Plan, the TMI-2 Radiation Protection Plan and all procedures in the TMI-2 RCPM on at least an annual basis.
5. The Plant Operations Review Committee shall review and comment on the TMI-2 Radiation Protection Plan and any changes thereto. They also have the responsibility to review those procedures requested by the Manager Radiological Controls.
6. Periodically, the services of an outside consultant will be retained to provide evaluation and guidance on ways to improve the TMI-2 Radiological Controls Program.
7. In addition to these reviews and audits, a system shall be employed to identify radiological control deficiencies. A radiological control deficiency is defined as either a violation of an established procedure or a practice which could and should be improved. Such deficiencies are recorded in a Radiological Deficiency Report. This system shall be specified in the TMI-2 RCPM embodying the following concepts. A Radiological Deficiency Report may be initiated by any individual who

observes a deviation from good radiological practices. These reports shall be evaluated by Radiological Technical Support for desirable or necessary corrective action. The purpose of this system is to identify all deficiencies, regardless of how small or inconsequential, correction of which will result in an improved Radiological Controls Program. Radiological Technical Support shall prepare a monthly report summarizing the Radiological Deficiency Report findings and corrective action taken.

8. The Nuclear Regulatory Commission (NRC) also inspects and reviews the TMI-2 Radiological Controls Program. The TMI-2 Radiation Protection Plan and any changes thereto shall be submitted to the NRC for approval. Changes to the initial TMI-2 RCPM will be submitted to the NRC for comment. Subsequent changes to the TMI-2 RCPM will be submitted to the NRC for information.
9. In the event all the preceding measures fail to prevent a radiological incident, an investigation shall be conducted to determine the causes of the incident and to determine the corrective actions and improvements needed.



Article 4 - Radiological Controls Training

1. Periodic radiological control training shall be given to ensure each person understands the radiological conditions to which he is exposed, understands his responsibility to minimize his own exposure to radiation, and understands his own responsibilities for complying with radiological control procedures. Personnel occupationally exposed to radiation shall receive instruction on the effects of radiation and the risks associated with radiation exposure.
2. General radiological indoctrination shall be given to those not directly involved with radiation so that they understand not to enter areas requiring TLDs and not to cross radiation barriers. The indoctrination shall include explanation of the radiological environment in which they work.
3. Radiological control training shall be given to personnel requiring access to a restricted area. These personnel shall be required to pass a written examination, and they shall requalify by written examination at least annually.
4. In addition to the training and written examinations of paragraph 3, those who require access to areas controlled by Radiation Work Permits shall receive more extensive training and shall be required to pass a radiological examination on their practical abilities, including use of dosimetry, frisking, anticontamination clothing, respirators, and response to unusual situations. Retraining, and both written and practical examinations shall be conducted at least annually. In addition,

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spot checks shall be made that they retain the required knowledge during the period between examinations. Special briefings and extra training including use of mockups where applicable, shall be conducted for work involving higher than usual exposures to radiation and radioactivity.

5. Radiological control technicians and their foremen shall receive theoretical and practical training and training for unusual situations. Training shall also be given for changes to procedures, equipment and programs. They shall pass both written and oral examinations, in which the passing grade for foremen shall be higher than the passing grade for technicians. Periodic practical drills and oral drills shall be required for each technician and foreman. Annual requalification shall be required including both written and oral examinations. Radiological control technician assistants shall perform specific functions under direction of a qualified technician or foreman and only after being qualified for the specific function.



Article 5 - Control of External Exposure

Control of radiation exposure is based on the assumption that any exposure no matter how small involves some risk; however, exposure within the accepted limits represents a risk small compared with normal hazards of life. Therefore the policy of Metropolitan Edison Company and General Public Utilities Corporation is to maintain exposures to individuals and total man-rem as low as is reasonably achievable (ALARA). Line management from all departments as well as each individual worker shall take an active role in radiation exposure reduction.

To aid in exposure reduction, administrative radiation exposure control levels shall be established. Radiation man-rem exposure goals shall be established for each major job and for each year. Work involving radiation exposure shall be preplanned, major exposure jobs shall require that radiological controls be incorporated in the design, that written procedures be prepared, and that pre-job briefing and rehearsals be conducted prior to commencing work. A Radiation Work Permit will be required for any work or entry to restricted areas that would involve or create any of the following: (a) high radiation area, (b) airborne radioactivity area, and (c) contaminated area, or (d) those radiation areas specified in applicable procedures.

Restricted areas used to control personnel access to radiation and radioactive materials shall be defined, access controlled, and posted in accordance with 10 CFR 20.203 with the following modifications:

1. Each High Radiation Area shall be barricaded and conspicuously posted as a High Radiation Area, and personnel desiring entrance shall obtain a Radiation Work Permit (RWP). Any individual entering a High Radiation Area shall (a) use a dose

- rate monitoring device or (b) use a radiation dose rate integrating device which alarms at a preset dose level, or (c) assure that a radiological control technician provides periodic radiation surveillance with a dose rate monitoring instrument.
2. Any area accessible to personnel where a major portion of the body could receive in any one hour a dose in excess of one thousand mrem, shall be locked to prevent unauthorized entry. The keys to these locked barricades shall be maintained under the administrative control of the Lead Radiological Controls Foreman on duty in accordance with the RCPM.

Radiological Controls personnel shall be exempt from the RWP issuance requirement during the performance of their assigned radiation protection duties providing they are following radiological control procedures for entry into High Radiation Areas.

To evaluate radiological conditions, radiation surveys shall be conducted for air activity, removable surface contamination and external radiation at regular intervals. Surveys are performed in order to (a) monitor the suitability of control measures, (b) evaluate the needs for additional controls, (c) evaluate trends for ALARA purposes, and (d) evaluate radiological conditions in areas routinely entered without radiation work permit coverage. Surveys in unrestricted areas are provided to insure the effective control of radioactive material. Unusual conditions detected in the performance of either a routine or special survey shall immediately be brought to the attention of Radiological Controls Management. Portable radiation survey instruments will be



calibrated seminannually, except for dose rate measuring instruments, which will be calibrated quarterly, to assure a consistent, reliable and predictable response to radiation levels. Records of surveys shall be maintained on file. An Administrative program will be used to verify the calibration of personnel and field monitoring instruments.

Article 6 - Control of Internal Exposure

The policy of Metropolitan Edison Company and General Public Utilities Corporation is not to have any significant internal exposure to personnel from radioactivity associated with Three Mile Island Unit 2. For personnel exposed to radioactivity during their work, this means that no one should receive from internal radioactivity more than one tenth of their permitted annual radiation exposure .

Controls in other parts of this TMI-2 Radiation Protection Plan to minimize internal radioactivity, such as control of surface contamination and control of wounds, are not repeated in this article. The following controls are to minimize internal exposure from airborne radioactivity:

1. Engineering controls and controls on personnel access shall be applied to the maximum extent practicable so that radioactive work does not increase the amounts of airborne radioactivity inhaled. When no other controls are practicable, respirators shall be used. Those who may need to use respirators shall be medically qualified, trained, tested for respirator efficiency, and requalified in this respirator program at least annually.
2. Airborne radioactivity shall be measured regularly in areas where personnel may be exposed. Continuous monitoring representative of air the person is breathing shall be performed to supplement periodic measurements during work which has the potential to cause a worker to receive measurable internal radioactivity.

Internal radioactivity shall be measured at least annually in each person who works in an area requiring a radiation work permit; this



includes each person who wears respiratory protection. Internal radioactivity shall be measured promptly in each person who receives radioactive contamination on his skin, and in each person who is suspected of inhaling sufficient radioactivity to cause measurable internal radioactivity. Each measurement of internal radioactivity above a level near background shall be reviewed to determine the cause and to assist in minimizing internal exposures.

## Article 7 - Control of Radioactive Contamination

Radioactive surface contamination shall be controlled in order to minimize possible inhalation or ingestion of radioactivity and to minimize buildup of radioactivity in the environment. Measures to contain radioactivity and to minimize the number and extent of areas contaminated shall be taken in order to minimize personnel radiation exposure, to simplify subsequent personnel and area or facility decontamination, and to minimize the need to rely on anticontamination clothing.

The surface contamination limits for beta and gamma activity shall be 500 dpm/100 cm<sup>2</sup> for removable contamination using shielded smear counters, 100 cpm for total contamination measured with a pancake GM detector or 0.1 mr/hr for total contamination measured with a standard GM tube. (The preferred means of monitoring for surface contamination will be with a pancake GM detector). For alpha activity, the surface contamination limits are 20 dpm/100cm<sup>2</sup> for removable contamination measured with a shielded smear counter and 20 cpm for total alpha contamination if measured with an alpha survey meter.

Emphasis in planning, training and working shall be placed on minimizing the numbers of occurrences and amounts of radioactivity involved in occurrences in which radioactive surface contamination exceeds the above limits on a person's skin or in areas not controlled for radioactive surface contamination. Each such occurrence shall be reviewed in detail to determine how to correct deficiencies and improve control of radioactivity.



Article 8 - Control of Radioactive Materials

In addition to the definition of 10CFR20, radioactive material is any material having a dose rate measured with a beta gamma survey meter at 1 inch exceeding 0.1 mR/hr or with surface contamination in excess of the limits specified in Article 7. A radioactive material control system shall be established to ensure radioactive material is not lost or misplaced in a location where personnel could unknowingly be exposed to radiation and to prevent the uncontrolled spread of radioactivity to areas where the public might be affected. This system shall include the following requirements:

1. The number of areas in which radioactive materials are stored shall be minimized.
2. Any new radioactive material storage area shall be approved before use by the Manager Radiological Controls.
3. The numbers of radioactive items and the amount of radioactivity in storage shall be minimized.
4. Radioactive items shall be identified as radioactive before removing them from a restricted area.
5. Radioactive materials removed from the Protected Security Area or removed from a restricted area outside the Protected Security Area shall be controlled in accordance with an accountability procedure which ensures the materials are not lost or improperly handled during transfer or subject to unauthorized removal. This accountability procedure shall require inventory of radioactive materials which remain outside such areas.
6. Each incoming or outgoing shipment of radioactive material shall be handled in strict compliance with detailed written procedures.

Each case in which radioactive material is lost or unaccounted for shall be reviewed in detail to determine the potential radiation exposure personnel might unknowingly receive, to correct deficiencies, and to improve control of radioactive materials.



## Article 9 - Organization for Radiological Controls

A radiological control program cannot be strong and effective if left solely to the Radiological Controls Department. Each worker and supervisor has responsibility for radiological control; consequently, the organization for the entire Three Mile Island Unit 2 represents the organization for radiological control.

However the Manager Radiological Controls is responsible for ensuring that a high quality radiological controls program is established and maintained. It is the responsibility of the Radiological Control Department to evaluate radiological conditions and determine appropriate precautionary measures. To assist the Manager Radiological Controls, a Radiological Controls Department is organized as shown in Figure 1.

Qualifications for the key radiological managers in NRC Regulatory Guide 1.8, Rev. 1-R, (1975) will be met as far as practicable. Where the combination of strong manager and experience in radiological controls cannot practicably be obtained in the same person, a deputy will be appointed who will meet the NRC requirements.

One portion of the TMI-2 radiological controls program is the ALARA program for personnel radiation exposures to be as low as reasonably achievable. To accomplish this each engineer involved with TMI-2 has to have radiological engineering as part of his assignment. Thus, most radiological engineering functions are performed in engineering groups rather than in the Radiological Controls Department. The overall coordination of the TMI-2 ALARA program, however, is assigned to Radiological Technical Support in the Radiological Controls Department.

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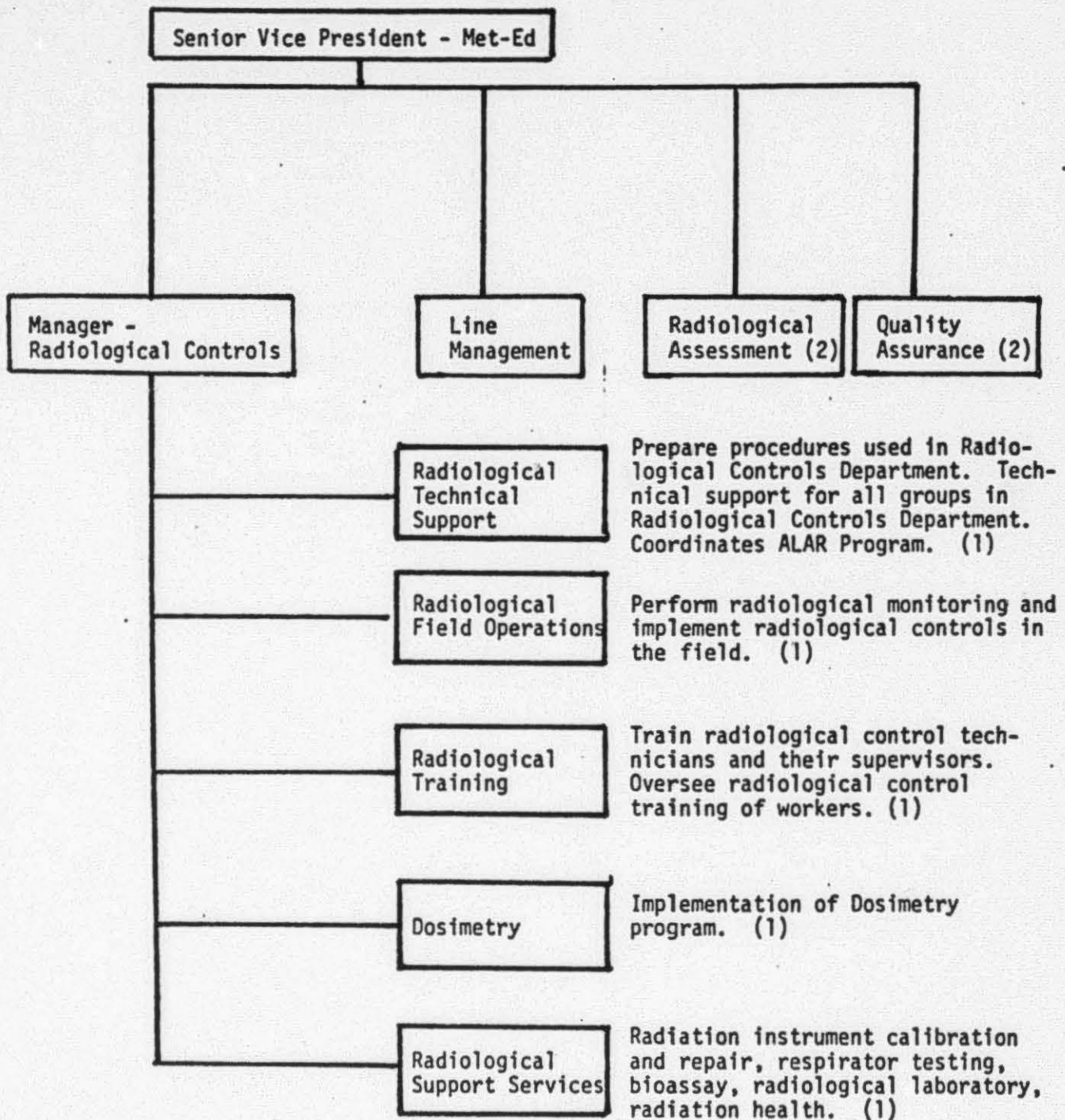


Figure 1 TMI-2 Radiological Controls Organization

- (1) See the organization functional responsibilities document contained in the RCPM for specifics.
- (2) Diagram indicates organization independence and accessibility to senior management - not details of organization structure.



## METROPOLITAN EDISON COMPANY

Subsidiary of General Public Utilities Corporation

Subject Surface Contamination Limits

Location TMI II

Date January 14, 1980

To Radiation Protection Plan File

The control of surface contamination during recovery operations is necessary to limit the release of radioactivity to unrestricted areas and to minimize the potential for unnecessary personnel contamination and subsequent radiation exposure. Surface contamination limits are used to evaluate whether a surface may be released for unrestricted use or an item may be released to an unrestricted area without the need for additional protective measures. These limits must be established low enough to provide adequate assurance of radiological safety yet high enough to be detectable with practical efficient survey techniques. ANSI N13.12-1978, "Control of Radioactive Surface Contamination on Materials, Equipment and Facilities to be Released for Uncontrolled Use," recommends contamination criteria for uncontrolled release to unrestricted areas.

The surface contamination limits recommended in this standard vary with the hazard potential of the radioisotope represented by their "Maximum Permissible Concentrations" in air or water. The principal fission products encountered thus far in decon efforts at TMI II are Cs-134, Cs-137, Sr-89, and Sr-90. Although Cs-134 and Sr-89 will decay away during the recovery, the Cs-137 and Sr-90 will be a continuing concern throughout the decon operations. ANSI N13.12-1978 divides the radioactive elements into three (3) groups; Group I includes alpha emitters, Group II includes the more hazardous beta emitters and the naturally occurring alpha emitters, Group III is all other isotopes. Of the major fission products that will be dealt with during TMI II Recovery, all fall in Group III except Sr-90. The recommended removable surface contamination limit for Group III isotopes is 1000 dpm/100 cm<sup>2</sup>; for Group II isotopes, it is 200 dpm/100 cm<sup>2</sup>.

Although Sr-90 will be present throughout the recovery, it is not reasonable to expect it will be present alone. For example, Sr-90 is presently about 15% of the activity in the primary coolant system. Consequently adopting the contamination limits appropriate for Group II isotopes would be unduly restrictive; conversely, adopting the limits for Group III isotopes may be non-conservative. If these two limits were combined according to the weighted ratios of the Group II and Group III activities, a reasonable contamination limit would result. If Sr-90 were conservatively assumed to be 25% of the activity, the resulting limit would be 500 dpm/100 cm<sup>2</sup>.

While this level is readily detectable by normally used smear techniques using a shielded smear counter, it becomes marginally detectable with a hand-held field survey instrument. Due to the very large areas that will need to be surveyed frequently during the recovery effort, it is imperative that contamination surveys can be done efficiently, and compared to a definitive criteria. The instrument of choice for contamination surveys shall be the pancake-type GM probe known as the HP-210 attached to rate meters such as the Ludlum RM-14 or the Eberline E-520. This probe has an efficiency of 10-20% for beta radiation, the higher value being typical for higher energy betas such as associated with Sr-90, Y-90 or Ce-144/Pr-144. Using these efficiencies and the above derived limit, the limit as measured by an HP-210 would be 50-100 cpm/100 cm<sup>2</sup>. The background on the HP-210 is normally 50-70 cpm in the TMI II area, making an increase of 50 cpm marginally detectable, while a 100 cpm increase is readily discernible by a careful monitor.

INTER-OFFICE MEMORANDUM

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