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132 - 132 - OSC COORDINATOR: EMERGENCY PLAN-POSITION SPECIFIC PROCEDURE

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PPL EMERGENCY PERSONNEL DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATION (PAR) GUIDE

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NOTE: **EMERGENCY EXPOSURE EXTENSION REQUEST FORM** and **POTASSIUM IODIDE TRACKING FORM** can be found as Forms EP-AD-000-135 and EP-AD-000-141, respectively.

PPL EMERGENCY PERSONNEL DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATION (PAR) GUIDE

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1.0 Limits for **EMERGENCY** doses.

☐ 1.1 An **EMERGENCY DOSE AUTHORIZATION** (see EMERGENCY EXPOSURE EXTENSIONS) may be granted in order to protect facilities, and or equipment to substantially limit the escape of radioactive effluents or control fires. The maximum planned doses are:

1.1.1 Whole body (TEDE)[1] dose shall not exceed 10 rem.

1.1.2 Dose to any organ (CDE)[2], including the skin and extremity (SDE)[3], shall not exceed 100 rem.

1.1.3 Dose to the lens of the eye shall not exceed 30 rem (LDE)[4].

☐ 1.2 An **EMERGENCY** dose authorization may be granted for life-saving actions or protection of large populations. The maximum doses are:

1.2.1 Planned whole body (TEDE)[1] doses shall not exceed 25 rem.

1.2.2 Planned dose to any organ (CDE)[2], including skin and extremity doses, shall not exceed 250 rem.

1.2.3 Dose to the lens of the eye shall not exceed 75 rem (LDE)[4].

1.3 **RARE** situations may occur in which a dose **GREATER THAN** those specified in SECTION 1.2 above for emergency dose would be unavoidable to carry out a lifesaving operation or to avoid extensive exposure of large populations. It is not possible to prejudge the risk that one should be allowed to take to save lives of others, therefore no upper limit has been established.

(1) The sum of the Effective Dose Equivalent resulting from the exposure to external sources and the Committed Effective Dose Equivalent incurred from all significant inhalation pathways during the early phase.

(2) The Committed Dose Equivalent to the thyroid from radioiodine.

(3) Shallow Dose Equivalent.

(4) Lens Dose Equivalent.

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2.0 For any **EMERGENCY EXPOSURE OR ACCIDENTAL OVEREXPOSURE**, the assessment actions in step 2 of the EMERGENCY EXPOSURE EXTENSIONS must be performed.

3.0 **PROTECTIVE ACTIONS**

☐ 3.1 Potassium Iodide

3.1.1 For thyroid doses that are strongly expected to exceed 10 rem (CDE)[2], ingestion of a KI dose of 130 mg (100mg - iodine) should be recommended, except as noted in paragraph 3.1.2, to personnel whose emergency assignment or qualifications do not allow other protective measures to be taken (e.g. respiratory protection, evacuation, relocation, etc.) to maintain the dose to the thyroid at less than 10 rem.

NOTE: HHS/FDA guidance is that adults over 40 years of age need take KI only in the case of a projected large internal radiation dose to the thyroid (> 500 rem) to prevent hypothyroidism; the guidance is 10 rem for adults over age 18 to age 40.

3.1.2 KI should not be administered to any emergency worker who:

a. does not concur with its use, or

b. has a known allergic reaction to iodine and/or foods containing iodine such as shellfish, or

c. has been directed by their Physician or Pharmacist to avoid ingestion of iodine and/or foods containing iodine such as shellfish.

[2] The Committed Dose Equivalent to the thyroid from radioiodine.

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3.1.3 Onsite issuance of KI for iodine prophylaxis requires the approval of the **EMERGENCY DIRECTOR**. Issuance to EOF and FIELD EMERGENCY MONITORING/SAMPLING TEAM personnel requires the approval of the **RECOVERY MANAGER** when the EOF has relieved the TSC of emergency management activities. The **EMERGENCY DIRECTOR** will approve issuance prior to that time. These approvals must be documented on the **POTASSIUM IODIDE (KI) TRACKING FORM.**

3.1.4 Unless the EMERGENCY DIRECTOR or RECOVERY MANAGER instructs personnel to do otherwise, the KI tablets should generally be taken as soon as possible after thyroid dose exceeding 10 rem CDE [(2)] is projected.

NOTE: Stable iodine (KI) is most effective when administered immediately prior to exposure to radioiodine. Significant blockage of the thyroid dose can be provided by administration within a few hours after uptake of radioiodine.

3.15 In the event a significant exposure to the thyroid is projected to continue over a period of several days the CONSULTING RADIOLOGICAL PHYSICIAN should be requested to provide a recommended KI dosage for subsequent KI usage. (See Emergency Telephone Directory for telephone number.)

3.16 Until input/advice from the CONSULTING RADIOLOGICAL PHYSICIAN is available, a quarter of a tablet should be taken on days of exposure that follow the day on which the initial full tablet dose (130 mg) was taken.

3.17 If a worker expresses concern with the use of KI and/or is unsure if it will interact with his/her current medication,

a. the CONSULTING RADIOLOGICAL PHYSICIAN should be requested to provide input/advice to the individual concerning the administration and cessation of KI use prior to its ingestion by the individual. (See Emergency Telephone Directory for telephone number.)

(2) The Committed Dose Equivalent to the thyroid from radioiodine.

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b. control and track workers' dose, to limit their projected thyroid dose to 40 rem total organ dose. As warranted, ensure adjusted RWP controls and dose extensions are in place.

3.1.8 Should the projected dose to the thyroid not exceed 10 rem CDE [2] but the worker expresses the strong desire to use KI, the worker may do so at his/her own risk. In such case, the RPC or DASU as appropriate will inform the worker of the potential risks and benefits as described below and will recommend the person contact the CONSULTING RADIOLOGICAL PHYSICIAN for further guidance.

NOTE: Radiation exposure to the thyroid glands of adults does not appear to lead to cancer but has been shown to cause other deterministic effects (such as hypothyroidism resulting from thyroid ablation) from very high radiation doses to the thyroid.

For persons over 40 years of age, HHS/FDA recommends KI only for projected doses to the thyroid of above 500 rem, to prevent hypothyroidism.

The National Council on Radiation Protection and Measurement (NCRP Report No. 55) concludes that the risk of adverse effects from use of KI is on the order of 5 in 10 million.

In some cases, hyperthyroidism (excessive functional activity of the thyroid gland) is possible. Those most at risk are patients with thyroid pathologies. This is most common in patients with goiter. This complication can be serious when the person also has heart disease. The risk of adverse effects is higher in adults of age 45 years and older, due to the frequency of diagnosed and sub-clinical thyroid disease and the use of certain prescription pharmaceuticals that would lead to a drug interaction.

[2] The Committed Dose Equivalent to the thyroid from radioiodine.

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HHS/FDA observes that short-term administration of KI at thyroid blocking doses is safe. The risks of stable iodine administration include sialadenitis (an inflammation of the salivary gland), gastrointestinal disturbances, allergic reactions, and minor rashes. Other risks may apply if repeated doses of KI are ingested.

3.1.9 If the individual states the intent to take KI absent a projected dose of 10 rem (CDE)[2] or more, the RPC or DASU will document in his/her logbook that individual's intent, that information on risks and benefits was described to the individual, and the statement that the individual was notified that ingestion was at the individual's own risk.

3.1.10 For an injured and/or contaminated worker sent to a hospital for treatment, the patient will be under the care of the attending physician. As such, plant procedures no longer apply and KI issuance will be at the discretion of the attending physician. The physician can rely on a senior Health Physics Technician Level II or Health Physics Management to provide the in-plant radiological data on which to base their decision.

☐ 3.2 Protective measures should be implemented for EOF personnel at the direction of the **DOSE ASSESSMENT SUPERVISOR**, within the bounds of RWPs #8001 and #8002. Consultation with and approval by the RPC is needed for RWP revisions.

☐ 3.3 Exposures to members of local offsite support groups, (ambulance workers, fire fighters) shall not exceed 500 mrem (TEDE)[1] for the performance of support duties on the site of the Susquehanna SES.

(2) The Committed Dose Equivalent to the thyroid from radioiodine.

(1) The sum of the Effective Dose Equivalent resulting from the exposure to external sources and the Committed Effective Dose Equivalent incurred from all significant inhalation pathways during the early phase.

PPL EMERGENCY PERSONNEL DOSE ASSESSMENT AND PROTECTIVE ACTION RECOMMENDATION (PAR) GUIDE

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4.0 **EMERGENCY EXPOSURE NOTIFICATIONS AND A HEALTH CONSEQUENCE INVESTIGATION** must be conducted for any emergency exposure as outlined in step 6 of the Emergency Exposure Extensions.

NOTE: Reference for section 3.1 are as follows:

1. HHS/FDA Guidance-Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergencies, December 2001.

2. LeGuen, B. et.al., French Approach for the Distribution of Iodine Tablets in the Vicinity of Nuclear Power Plants, Health Physics 2002.

3. PEMA, Report to the REPAC from the Potassium Iodide Working Group, January 2001.

EMERGENCY EXPOSURE EXTENSIONS

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1. Fill out the attached **EMERGENCY EXPOSURE EXTENSION REQUEST** Form.

2. Review the following factors:

   ☐ Rescue personnel should be volunteers or professional rescuers.

   ☐ Other considerations being equal (e.g., skill, potential need for person on another mission) personnel above the age of 45 are preferred.

   ☐ Rescue personnel should be familiar and briefed with the consequences of exposure.

   ☐ Women capable of reproduction should not take part in an effort requiring EMERGENCY exposure.

   ☐ Use of personnel with high lifetime cumulative exposure should be discouraged.

   ☐ All reasonable measures must be taken to control contamination and internal exposure.

   ☐ Exposure under these conditions shall be limited to once in a lifetime.

   ☐ For exposures greater than 25 rem whole body (TEDE), the persons undertaking any emergency operation in which the dose will exceed 25 rem to the whole body (TEDE) should do so only on a voluntary basis and with full awareness of the risks involved, including the numerical levels of dose at which acute effects of radiation will be incurred and numerical estimates of the risk of delayed effects. See the following two tables for general information concerning Health Effects & Cancer Risks.

EMERGENCY EXPOSURE EXTENSIONS

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Health Effects Associated with Whole Body Absorbed Doses Received Within a Few Hours[a]

Whole Body Absorbed Dose (rad)	Early Fatalities[b] (percent)	Whole Body Absorbed Dose (rad)	Prodromal Effects[c] (percent affected)
140	5	50	2
200	15	100	15
300	50	150	50
400	85	200	85
460	95	250	98

(a) Risks will be lower for protracted exposure periods.
(b) Supportive medical treatment may increase the dose at which these frequencies occur by approximately 50 percent.
(c) Symptoms (nausea, vomiting) which occur within a few hours after exposure to large doses of radiation and which usually precede more serious health effects.

Approximate Cancer Risk to Average Individuals from 25 Rem Effective Dose Equivalent Delivered Promptly

Age at Exposure (years)	Approximate Risk of Premature Death (deaths per 1,000 persons exposed)	Average Years of Life Lost if Premature Death Occurs (years)
20 to 30	9.1	24
30 to 40	7.2	19
40 to 50	5.3	15
50 to 60	3.5	11

3. Review the **HEALTH PHYSICS AND ALARA CONSIDERATIONS DURING EMERGENCIES** which is attached.

4. Obtain appropriate approval signatures as outlined in the table below.

EXTENSION		APPROVAL	ACTIONS
FROM mrem (TEDE)	TO mrem (TEDE)		
4000	<25000	(ED or RM) and RPC	ALARA REVIEW AND APPLY EMERGENCY EXPOSURE CONSIDERATIONS
>25000		(ED or RM) and RPC	ALL OF ABOVE AND BRIEFING ON RISKS

EMERGENCY EXPOSURE EXTENSIONS

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5. If the Emergency Dose Extension is for greater that 4 rem (TEDE), have the volunteer sign the **EMERGENCY EXPOSURE REQUEST** Form acknowledging that they are a volunteer and are fully aware of the radiological risks of acute and delayed effects.

6. Upon completion of the activity requiring the Emergency Exposure perform the following:

   ☐ Collect, process, and evaluate personnel dosimetry devices when technically appropriate.

   ☐ Investigate the circumstances of all emergency exposures and confirm the dose received.

   ☐ Notify the NRC of emergency exposure as follows:

   Immediate notification of the NRC is required for:

   a. Exposure of the whole body of greater than 25 rem (TEDE); or
   b. Exposure of the skin of the whole body of greater than 150 rem (SDE); or
   c. Exposure of the extremities of greater than 375 rem (SDE).

   Notification of the NRC **within 24 hours** is required for:

   a. Exposure of the whole body of greater than 5 rem (TEDE); or
   b. Exposure of the skin of the whole body of greater than 30 rem (SDE); or
   c. Exposure of the extremities of greater than 75 rem (SDE).

   ☐ Assess the health consequences of all emergency exposures. Consult with a physician to determine the need for and extent of physical and biochemical examinations.

   ☐ Whole body greater than 25 rem (TEDE) should result in an examination of the exposed person by a physician.

   ☐ If internal exposure is suspected, quantitative measurements should be made as soon as reasonably feasible. Bioassays are required based on the following:

   - Nasal smear or facial contamination greater than 1,000 cpm above background.
   - Greater than 4 DAC-HRS in a day or less, or 20 DAC-HRS in a week or less.

HEALTH PHYSICS AND ALARA CONSIDERATIONS DURING EMERGENCIES

CHECK ☐

1.0 Evaluate radiological conditions.

1.1 Obtain detailed survey data to ascertain:

1.1.1 Beta-Gamma radiation levels

1.1.2 Need for neutron measurements

1.1.3 Contamination levels and protective clothing requirements

1.1.4 Airborne radioactive materials

1.1.5 Variability of conditions over space and time

1.2 Evaluate personnel status.

1.2.1 Determine available dose under normal administrative dose objectives.

1.2.2 If essential, obtain approval from **RADIATION PROTECTION COORDINATOR/EMERGENCY DIRECTOR** for persons expected to exceed administrative objectives.

1.2.3 Follow criteria in PPL Emergency Personnel Dose Assessment and Protective Action Recommendation Guide when emergency exposures are deemed appropriate by **EMERGENCY DIRECTOR**.

1.2.4 Assess individual's history of exposure to airborne materials.

1.2.5 Assess individual's skills in relation to proposed task.

1.2.6 Assess individual's lifetime exposure history.

HEALTH PHYSICS AND ALARA CONSIDERATIONS DURING EMERGENCIES

CHECK ☐

1.3 Determine proper type and placement of dosimeters.

1.3.1 Evaluate need for additional whole body dosimeters.

NOTE: For emergency exposures above 4 rem, the placement of several dosimeters on an individual is recommended to determine spatial distribution of dose to the individual.

1.3.2 Evaluate need and placement of extremity dosimeters.

1.3.3 Evaluate need for additional dosimetry devices such as high range self-reading dosimeters, electronic dosimeters, and neutron dosimeters.

1.3.4 Evaluate need for time keeping.

1.4 Determine proper respirator equipment required to perform task.

NOTE: For tasks expected to last more than several hours, consider need for relief of team members.

1.5 Review the following ALARA items:

NOTE: The detail and scope of ALARA reviews are to be commensurate with the magnitude of doses expected, numbers of people involved, and urgency of required task.

1.5.1 Consider the trend of exposures vs. the importance of the task:

a. Important and critical task with rising exposure rates will require the dispatch of teams as quickly as possible to reduce exposures.

b. Unimportant or less critical task could be delayed until exposure rates begin to trend downward.

HEALTH PHYSICS AND ALARA CONSIDERATIONS DURING EMERGENCIES

CHECK ☐

1.5.2 When time permits the following should be included in the ALARA review:

a. Consider the use of remote handling devices or other special tools.

b. Consider the use of portable shielding.

c. Consider the need for mock-ups or other practice exercises.

d. Assess the number of people required to assure all have essential productive roles.

e. Consider the magnitude of doses received by team members in transit to work location.