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Title: Radiological Ground Water Monitoring Program

	Reviews	Required	
•	Cross Discipline Review	_Yes_	
· .	Code Reviews:		
	10CFR50.59 Review	Yes	
	10CFR50.54 Review	No	
	On-Site Safety Review Committee Reviews		
•			•
Procedure Owne	er: Daniel Wilson / Chemistry Supe	erintendent	
	Print Name / Title		/ /
Approved:	and such,		1/8/18
·	Procedure Owners signature		(Date)
Approved			1-11-08
•	IPEC Site VP/Designee Signature		(Date)
Effective Dates:	1/11/08 1/11/08		. '
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New Procedure/Revision/Cancellation Basis:

This new procedure is established to:

- Establish an IPEC ground water monitoring program to support implementation of EN-RP-113, Response to Contaminated Spills/Leaks
- Meet Nuclear Energy Institute Industry Ground Water Protection Initiative
- Address issues discussed in NRC Information Notice 2006-13: Ground-Water Contamination Due To Undetected Leakage of Radioactive Water
- Implement IPEC commitments to the NRC made in Entergy Letter NL-06-033, "Current Status/Future Plans Regarding Onsite Groundwater Contamination at IPEC"



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1.0 PURPOSE

1.1 To establish the objectives, organizational roles and responsibilities, and the program elements and requirements, for the radiological ground water monitoring program.

2.0 PRECAUTIONS AND LIMITATIONS

2.1 Caution should be exercised when formulating actions based upon the indicator radionuclides; tritium (H-3) or strontium 90 (Sr-90) with results below 500 pCi/L or below 1 pCi/L, respectively. Results at these levels can be observed due to statistical counting errors, laboratory analysis or chemical separation errors, trace level cross contaminations, local deposition from monitored atmospheric plant releases or from background levels of these radionuclides in precipitation, drinking water and surface water in the natural environment. Re-analysis, re-sampling and trending over several data points should be initiated to confirm ground water contamination prior to making notifications or taking more aggressive actions based upon such results.

3.0 DEFINITIONS

- 3.1 Boundary Monitoring Well A ground water well located and used to provide early detection of licensed radioactive material prior to transport to adjacent properties via ground water.
- 3.2 Containment An action or engineered control to limit the spread or migration of a contaminant.
- 3.3 Indicator Monitoring Well– A ground water well located within the Protected Area, used for one or more of the following purposes:
 - Detection of previously unidentified sources of ground water contamination resulting from leaks or spills.
 - Monitoring of known sources of ground water contamination.
 - Identification of trends in the nature and extent of existing on-site ground water plumes.
 - Monitoring of progress of remediation/intervention activities.
- 3.4 Investigation/Characterization Sampling, tests and evaluations initiated when radioactive ground water contamination is suspected or has been identified to determine the source(s) of contamination, determine the locations, extent and concentrations of ground water contamination and/or to further study the hydrogeology of the effected area.
- 3.5 Indicator radionuclides- Specific radionuclides that are selected for monitoring, based upon their abundance in a source-term, migration characteristics in ground water, or their potential for adverse impact, which can be used to indicate the general nature and extent of ground water contamination or detect leaks from a structure or component containing radioactive fluids.
- 3.6 River Front Monitoring Well A ground water well used to monitor the concentrations and total activity of licensed radioactive material released to the Hudson River via ground water.



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- 3.7 Stake Holder A non-regulatory individual or group with an official capacity or responsibility for the welfare of the community and a desire to be involved in environmental issues.
- 3.8 Investigation Level A condition or status in a monitoring well that will initiate an evaluation or other actions.

4.0 **RESPONSIBILITIES**

4.1 Chemistry Superintendent

- 4.1.1 Has ultimate responsibility for the Radiological Ground Water Monitoring Program (RGWMP).
- 4.1.2 Ensures adequate funding and resources to implement the RGWMP.
- 4.1.3 Designates key individuals to implement the program.
- 4.1.4 Approves Annual Ground Water Monitoring Program Reports.

4.2 Chemistry Specialist

- 4.2.1 Responsible for coordinating staffing, equipment and services required to support the RGWMP. Duties include:
 - Procurement of hydrogeological and analytical laboratory services
 - Installation and maintenance of ground water wells
 - Maintenance and procurement of sampling and monitoring instrumentation and equipment
 - Conduct of sampling activities, and data collection, review, evaluation and reporting.
 - Estimates ground water budget annually to support staffing, equipment and services
- 4.2.2 Maintains a listing of ground water well status and type.
- 4.2.3 Maintains records of ground water well inspections.
- 4.2.4 Maintains documentation for RGWMP wells specifying minimum sampling and analysis frequencies. As a minimum the following should be specified:
 - Well designator (e.g. MW-30-69)
 - Frequency at which each location is to be sampled (e.g., quarterly, semiannually, annually, etc.)
 - Required analyses (e.g. H-3, gamma spectroscopy, Sr-90, transuranics) and Minimum Detectable Concentrations (MDC's) for each analysis.
- 4.2.5 Coordinates split samples with NY State and NRC as necessary.
- 4.2.6 Maintains and approves changes to ground water monitoring program procedures, training and Technical Information Documents.
- 4.2.7 Periodically reviews the RGWMP sampling wells, frequencies and required analyses for changes.



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- 4.2.8 Organizes and schedules sampling to meet project objectives.
- 4.2.9 Performs data review.
- 4.2.10 Performs or provides support for performance of technical evaluations, assessment reports and calculations.
- 4.2.11 Identifies and reports results above investigation levels. The Radiation Protection Manager (RPM) is consulted and communication is through EN-RP-113
- 4.2.12 Prepares Annual Ground Water Monitoring Program Reports.
- 4.2.13 Responsible for maintenance and administration of the ground water data management system.

4.3 Chemistry Supervisor

4.3.1 Designates individuals to fill positions of Ground Water Sampling Technician(s).

Note

This currently is a contractor filled position

- 4.3.2 Supervises Ground Water Sampling Technicians.
- 4.3.3 Schedules and plans sampling events in accordance with the frequencies specified by the Chemistry Specialist.

4.4 Ground Water Sampling Technician(s)

- 4.4.1 Collects samples in accordance with approved procedures.
- 4.4.2 Delivers samples to on-site laboratory, shipping and storage areas as directed.
- 4.4.3 Decontaminates and maintains sampling equipment and supplies as directed.
- 4.4.4 Logs and documents sample collection information as directed.

5.0 DETAILS

5.1 Overall Objectives and Requirements

- 5.1.1 Procedures, staffing and equipment shall be maintained to monitor, investigate and characterize contamination of ground water with licensed radioactive material at Indian Point Energy Center (IPEC).
- 5.1.2 Monitoring activities shall be performed to accomplish one or more of the following objectives:
 - Monitor the status of any known radiological ground water plumes.
 - Detect and quantify previously unidentified sources of ground water contamination such as a spill or leak from a radioactively contaminated system, structure or component.
 - Provide data to calculate potential doses to a member of the public.
 - Monitor and evaluate the long term effectiveness of remediation or intervention actions.



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- 5.1.3 Investigation/characterization activities are performed to evaluate and understand ground water contamination once it has been identified or an event such as a spill or leak with the potential to contaminate ground water to levels above the investigation levels has occurred. Investigation/characterization activities are conducted to accomplish one or more of the following objectives:
 - Determine the source(s) of ground water contamination (e.g., leaking radioactive components or systems, radioactive spills or legacy soil or bedrock contamination.
 - Determine the locations, extent and concentrations of ground water contamination (e.g., define the plume).
 - Evaluate necessary corrective/investigative actions, utilizing the Corrective Action Program.

5.2 Ground Water Well System Management

- 5.2.1 Ground water system wells will provide one or more functions:
 - · Provide long term monitoring/sampling capabilities.
 - Provide near term investigative/characterization sampling capabilities.
 - Collect hydro-geological data (e.g., water table levels, flows, etc.)
 - Support tests such as dye injection or draw down tests
 - Support remediation, containment or intervention activities.
- 5.2.2 Well maintenance and inspection of these wells include:
 - Inspection and authorizations to determine that a well is suitable for qualitative sampling.
 - Authorizations to change well status (e.g., "Active" and "Inactive").
 - Periodic evaluations of well instrumentation (such as transducers) used to provide hydrological data supporting the RGWMP.

Note

Transducer data is intended for hydrological model study for a finite period (e.g. 6 months to a year).

- 5.2.3 Hydrological data required to support the RGWMP shall be maintained in electronic or hard copy form as a plant record.
- 5.2.4 Maintain a list of monitoring wells, with their purpose and status. Attachment 8.1 is the current active RGWMP monitoring location list. Attachment 8.2 is the current inactive RGWMP monitoring location list.



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5.3 Sample Schedule and Planning

- 5.3.1 Sampling and analysis of wells shall be performed to meet the objectives of the RGWMP.
- 5.3.2 Routine sampling will normally be initiated at the beginning of each quarter (e.g. January, April, July and October).
- 5.3.3 Attachment 8.3 is the current RGWMP sampling locations and schedule with the analysis suites.

5.4 Sample Collection and Analysis

- 5.4.1 Sample collection, handling and tracking for RGWMP well samples shall be performed in accordance with GZA's Standard Operating Procedures, Reference 6.7.
- 5.4.2 If a sample cannot be collected during the sampling event due to such factors as no water or obstructions preventing access to the well, then document the condition in the field log book or equivalent.
- 5.4.3 Samples are normally sent to an approved off-site laboratory for analysis; however, analysis by the Chemistry Department laboratory may also be utilized.
- 5.4.4 Attachment 8.4 lists the routine offsite laboratory analysis Minimum Detectable Concentrations (MDCs) for the principle plant-related radionuclides. MDCs for plant-related gamma emitters are typically equal to those specified in the Offsite Dose Calculation Manual. On-site analysis of samples for H-3 will typically have an MDC of approximately 700 pCi/L.

5.5 Data Review and Management

- 5.5.1 Review incoming sample results to verify the following as a minimum:
 - All required analyses for each sample have been performed.
 - All required Minimum Detectable Concentrations have been met.
 - All QC sample results are satisfactory.
- 5.5.2 Import the results into the Analytical Data Management System (ADMS) ground water database.
- 5.5.3 Review the results for:
 - Any unusual results (e.g. very high or very low results).
 - Any unexpected results (e.g. radionuclides not detected before).
- 5.5.4 Compare results to the investigation levels identified in Attachment 8.5.

5.6 Notifications, Evaluations and Communication

5.6.1 If an investigation level has been reached, initiate a Condition Report and consider the following:



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Review Items:

- Review well data trends over longer periods of time
- Review recent Condition Reports for spills or incidents in nearby areas
- Review recent rainfall data
- Evaluating the potential to change the off-site dose analysis

Communication considerations:

- Communicating to the stakeholders if the results identify newly detected short lived radionuclides indicating a new leak, an increase in the potential offsite dose that could approach 1 percent of the limit or confirmed elevated levels at a boundary well.
- Ensure NRC and DEC are notified prior to stakeholder notification

Note

Documentation, communication and reporting of spills and leaks will be in accordance with Entergy procedure EN-RP-113, "Response to Contaminated Spills/Leaks."

- Ensure any reporting requirements to the NRC are evaluated
- Ensure any REMP reporting requirements are evaluated

Action considerations:

- Contact the laboratory to assure that all QC checks were satisfactory, sufficient sample volume was used, required MDC's were met, etc.
- Re-sampling to verify the result
- Increased frequency of sampling
- Initiation of an investigation utilizing Entergy corrective action program and related resources as appropriate (e.g. site engineering / radiation protection)
- Initiation of source/ground water remediation techniques commensurate with the potential dose impact analyses and good environmental stewardship

Program Data Compilation and Reporting

- 5.7.1 Sample data shall be compiled, organized and reviewed annually as a minimum
 - Analyze for increasing or decreasing trends at individual sample points, wells or groups of wells. Include a review of seasonal and rainfall related fluctuations.
 - Review the radionuclides detected to determine whether changes should be made to the analysis suites or sampling frequencies for each sampling
 - Evaluate the locations of radionuclides in ground water to determine if changes should be made to the sampling locations



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- Review current investigation levels and determine if changes should be made
- An annual summary report of ground water program activities and results shall. 5.7.2 be prepared. This report shall be reviewed and approved by the Chemistry Superintendent, As a minimum this report shall contain the following:
 - Description of program objectives and activities conducted during the course of the year
 - Summarize any new hydrogeologic data obtained and tests performed during the previous year.
 - Summary of ground water sample results and trends observed
 - Quantification of any spills, leaks or any other new sources of ground water contamination observed during the course of the year
 - Determination of the new investigation levels for the next year (Attachment 8.5)
 - Recommendations for future ground water monitoring
- 5.7.3 The Radiological Environmental Monitoring Program (REMP) contact shall review the annual RGWMP report and ensure the sample results obtained from REMP wells listed in the Offsite Dose Calculation Manual (ODCM) are reported and summarized in the Annual Radiological Environmental Operating Report (AREOR).
- 5.7.4 The Radiological Effluent Controls contact shall review the annual RGWMP report and ensure the Annual Radiological Effluent Release Report (ARERR) includes:
 - A listing of non-REMP wells and a summary of pertinent sample results from the RGWMP are reported in the ARERR
 - An estimate of the doses to a member of the public associated with off-site releases of licensed radioactive material via ground water is included in the **ARERR**

5.8 **Program Self Assessments**

- An independent, knowledgeable individual shall perform an initial self 5.8.1 assessment after one year of implementation. [Reference 6.5]
- 5.8.2 Perform a periodic self assessment at least once every 5 years after the initial self assessment. [Reference 6.5]
- 5.8.3 Perform a review of the site hydrology every 5 years. [Reference 6.5]



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6.0 REFERENCES

- 6.1 Entergy Letter NL-06-033, Current Status/Future Plans Regarding Onsite Groundwater Contamination at IPEC, Fred Dacimo, Site Vice President, Indian Point Energy Center.
- 6.2 NRC Information Notice 2006-13, Ground-Water Contamination Due To Undetected Leakage of Radioactive Water.
- 6.3 10CFR §50.75(g), Reporting and Recordkeeping for Decommissioning Planning.
- 6.4 NRC Information Notice 2004-05 Spent Fuel Pool Leakage to Onsite Ground Water
- 6.5 NEI Industry Ground Water Protection Initiative Final Guidance Document, August 2007
- 6.6 EN-CY-109, Sampling and Analysis of Ground Water Monitoring Wells.
- 6.7 GZA-IP-001, Radiological Groundwater Monitoring Program Quality Assurance and Procedures
- 6.8 EN-RP-113, Response to Contaminated Spills/Leaks
- Analytical Data Management System (ADMS) ground water database by Radiation Safety and Control Services, Inc.

7.0 RECORDS AND DOCUMENTATION

7.1 Records

Records generated by this procedure shall be retained in accordance with the Indian Point Records Retention Schedule. They include:

- Radiological Ground Water Monitoring Program reports
- Records of well inspections and maintenance
- Lists of wells types and sampling frequencies
- Self assessments

7.2 Documentation

NONE

8.0 ATTACHMENTS

- 8.1 Active RGWMP Monitoring Locations
- 8.2 Inactive RGWMP Monitoring Locations
- 8.3 RGWMP Sampling Schedule and Analysis Suites
- 8.4 RGWMP Radionuclide Analysis MDCs
- 8.5 RGWMP Investigation Levels



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8.1

ACTIVE RGWMP MONITORING LOCATIONS

Sampling Location	Sampling Location Purpose / Comments			
LAF-002	Boundary Monitoring / Off-site	Active		
MW-30	U2 plume Mon. / U2 SFP Leak Detection	Active		
MW-31	U2 plume Mon. / SSC Leak Detection	Active		
MW-32	U2 plume Mon. / SSC Leak Detection	Active		
MW-33	U2 plume Mon. / SSC Leak Detection	Active		
MW-35	U2 plume Mon. / SSC Leak Detection	Active		
MW-36	U2 Plume Monitoring	Active		
MW-37	U1 / U2 Plume Monitoring	Active		
MW-39	U3 SSC Leak Detection	Active		
MW-40	Boundary Monitoring / REMP well	Active		
MW-41	U3 SSC Leak Detection	Active		
MW-42	U1 plume Monitoring	Active		
MW-43	U3 SSC Leak Detection	Active		
MW-44	U3 SSC Leak Detection	Active		
MW-45	U3 SSC Leak Detection	Active		
MW-46	U3 SSC Leak Detection	Active		
MW-49	U1 Plume Monitoring	Active		
MW-50	U1 Plume Monitoring	Active		
MW-51	Boundary Monitoring / REMP well	Active		
MW-52	U2 SSC Leak Detection	Active		
MW-53	U1 Plume Monitoring	Active		
MW-54	U1 Plume Monitoring	Active		
MW-55	U1 Plume Monitoring	Active		
MW-56	U1 Plume Monitoring	Active		
MW-57	U1 Plume Monitoring	Active		
MW-58	U3 Plume Monitoring	Active		
MW-60	Boundary Monitoring / River Front	Active		
MW-62	Boundary Monitoring / River Front	Active		
MW-63	Boundary Monitoring / River Front	Active		
MW-66	Boundary Monitoring / River Front	Active		
MW-67	Boundary Monitoring / River Front	Active		
MW-111	U2 plume Mon. / SSC Leak Detection	Active		
MW-107	Background - NRC Commitment Ac			
MH-5	U2 SFP / SSC Leak Detection	Active		
B-1	U3 SSC Leak Detection Active			
B-6	U3 SSC Leak Detection Active			
U3-T1	U3 SSC Leak Detection Active			
U3-T2	U3 SSC Leak Detection Active			
U1-CSS	U1 SSC Leak Detection Active			



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8.2

INACTIVE RGWMP MONITORING LOCATIONS

Sampling Location	mpling Location Purpose / Comments	
U3-1	U3 SSC Leak Detection	Inactive
U3-2	U3 SSC Leak Detection	Inactive
U3-3	U3 SSC Leak Detection	Inactive
U3-4D	U3 SSC Leak Detection	Inactive
U3-4S	U3 SSC Leak Detection	Inactive
MW-34	U2 SSC Leak Detection	Inactive
MW-38	River Front Monitoring	Inactive
MW-47	U1 SSC Leak Detection	Inactive
MW-48	River Front Monitoring	Inactive
MW-59 U3 SSC Leak Detection		Inactive
MW-65 U1 SSC Leak Detection Inc		Inactive
LAF-001	Boundary Monitoring / Off-site	Inactive
LAF-003	Inactive	



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8.3

RGWMP SAMPLING SCHEDULE AND ANALYSIS SUITES

Sampling	Sampling	Analysis Suite			
Location	Frequency	H-3	Sr-90	Gamma Spec	Ni-63
LAF-002	Semi-Annual	X	X	X	
MW-30	Quarterly	X	X	X	
MW-31	Quarterly	X	X .	, X	
MW-32	Quarterly	X	X	X	
MW-33	Annual	X	X	Х	
MW-35	Annual	X	· X	. X	
MW-36	Quarterly	X	X	X	
MW-37	Quarterly	X	X	/ X	·
MW-39	Semi-Annual	X	X	X	· · · · · · · · · · · · · · · · · · ·
MW-40	Quarterly	X	X	X	
MW-41	Semi-Annual	·X	X	X	
MW-42	Quarterly	X	X	X	X
MW-43	Semi-Annual	.X	X	X	
MW-44	Quarterly	X	X	X	,
MW-45	Quarterly	X	X	X	,
MW-46	Quarterly	X	X.	X	
MW-49	Quarterly	X	X	X	Χ.
MW-50	Quarterly	X	X	X	X
MW-51	Quarterly	X.	X	X	
MW-52	Annual	X	X	X	
MW-53	Quarterly	Χ	X	X	X
MW-54	Quarterly	Х	X	X	X
MW-55	Quarterly	X	X	X	X
MW-56	Semi-Annual	X	X	X	
MW-57	Semi-Annual	X	X	X	. X
MW-58	Semi-Annual	X	X	X	
MW-60	Quarterly	Х	X	X	
MW-62	Quarterly	Х	X	X	
MW-63	Quarterly	Х	X	X	· · · · · · · · · · · · · · · · · · ·
MW-66	Quarterly	Х	X	X	X
MW-67	Quarterly	X	X	X	X.
MW-111	Semi-Annual	Х	X	X	
MW-107	Annual	X	X	X	
MH-5	Quarterly	· X	X	. X	
B-1	Quarterly	X	X	X	
B-6	Quarterly	X	X	X	
U3-T1	Quarterly	Х	X	X	
U3-T2	Quarterly	X	X	X	
U1-CSS	Semi-Annual	X	X.	X	



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8.4

RGWMP RADIONUCLIDE ANALYSIS MDCs

Radionuclide	MDC (pCi/L)
H-3	200
Co-60	15
Ni-63	30
Sr-90	1
Cs-134	15
Cs-137	18

Note: These are target, a-priori MDCs



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8.5

RGWMP INVESTIGATION LEVELS

Well ID	H-3 (pCi/L)	Sr-90 (pCi/L)	Other Plant-related Radionuclides
LAF-002	Any detection See Note 1	Any detection See Note 1	Any detection See Note 1
MW-40, MW-51, MW-52, MW-107	1000	2	Any detection See Note 1
MW-60, MW-62, MW-63	2000	2	Any detection See Note 1
All remaining wells	See Note 2	See Note 2	See Note 2

- Note 1: A radionuclide is positively detected when the result is greater than or equal to 3 times the 1 sigma uncertainty.
- Note 2: Any positively detected radionuclide that has a result greater than 2 times the average from the previous year. The investigation level is not reached until an H-3 result is greater than 1000 pCi/L or a Sr-90 result is greater than 2 pCi/L.
- General Note: The values of 1000 and 2000 pCi/L for H-3 and 2 pCi/L for Sr-90 have been chosen such that they are low enough to assure timely detection of any new release or change to an existing release and be outside the normal expected range of sample results at these locations.