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September 21, 1994
Fort St. Vrain
P-94080

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

ATTN: Mr. John H. Austin, Chief
Decommissioning and
Regulatory Issues Branch

Docket No. 50-267

SUBJECT: Response to Comments Regarding the Final Survey Plan for Site Release

REFERENCES:

1. NRC Letter, Pittiglio to Crawford, received June 8, 1994 (G-94100)
2. PSC Letter, Warembourg to Austin, dated February 17, 1994 (P-94019)
3. NRC Letter, Pittiglio to Crawford, dated June 15, 1994 (G-94113)

Dear Mr. Austin:

This letter forwards responses to the NRC's comments regarding the Fort St. Vrain Final Survey Plan for Site Release, provided to Public Service Company of Colorado (PSC) in Reference 1. The NRC's comments were based on a review of the Final Survey Plan previously submitted in Reference 2. The attached comment responses include the modified release criteria for tritium and iron-55 fixed surface contamination described in Reference 3, and also reflect recent discussions with your staff.

As discussed during our meeting on July 26, 1994, PSC requests the NRC's assistance in releasing part of the FSV site prior to completion of the entire Final Survey, to support site repowering construction activities scheduled to begin in April 1995. PSC needs to release approximately 5 acres of open land area adjacent to the turbine building

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and east of the plant, for the installation of natural gas-fired combustion turbines and heat recovery boilers. To support our schedule, PSC requests that shortly after the Final Survey Plan is approved, a meeting be scheduled between the NRC, PSC, and any associated contractors directly involved in the early release of this area. The purpose of this meeting would be to clearly identify release protocols, survey guidelines, and any required actions could affect the initiation of construction activities.

In support of our efforts to release the repowering area for construction, PSC has developed a control plan to prevent recontamination of this area, once it has been determined to be "clean." A copy of this control plan, "Control Measures for Survey," is attached for your information. These Control Measures will also be used to prevent recontamination of other areas of the facility as they are determined to be "clean."

PSC believes that the information in the attached comment responses represents a conservative approach to ensuring that the FSV site can be released for unrestricted use upon the completion of decommissioning activities. Upon approval of the Final Survey Plan, PSC intends to update the Final Survey Plan to incorporate the attached responses to NRC comments, and to then transmit this updated Plan for your information.

If you have any questions regarding this information, please contact Mr. M. H. Holmes at (303) 620-1701.

Sincerely,



Don W. Warembourg
Decommissioning Program Director

DWW/SWC

Attachment

cc: w/attachment

Regional Administrator, Region IV

Mr. Robert M. Quillin, Director
Radiation Control Division
Colorado Department of Health

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FORT ST. VRAIN NUCLEAR STATION

FINAL SURVEY PLAN FOR SITE RELEASE

**RESPONSE TO NRC COMMENTS
PROVIDED IN JUNE 8, 1994 LETTER
FROM C. L. PITTIGLIO**

ATTACHMENT TO P-94080

NRC General Comment #1:

The plan does not describe the grid system to be used, or the frequency of measurements, in affected and unaffected areas. Please provide detailed descriptions of the sampling frequencies in all parts of affected (both suspect and non-suspect) and unaffected areas. Include the proposed maximum size of the "survey units," (see NUREG/CR-5849 for the definition of survey unit), and the maximum area to be represented by each measurement. NUREG/CR-5849 recommends 20 m² as the maximum area per measurement in affected areas above 2m, and 50 m² per measurement for unaffected areas.

PSCo Response: A survey unit is a contiguous area with similar characteristics and contamination potential. Survey units are established to facilitate the survey process and aid in the statistical evaluation of the survey data. Since survey units are designed to be contiguous areas with similar characteristics and potential for contamination, the actual size of a survey unit is not deemed to be critical, provided each survey unit contains a sufficient number of measurement locations.

Survey units are classified as affected, those with the potential of being contaminated, and unaffected. In addition, affected survey units within a room or building are subdivided into suspect and non-suspect survey units to allow for a concentrated survey effort in those areas most likely to be contaminated. By definition floors and walls below two meters in an affected area are classified as suspect. The walls above two meters and the ceiling in an affected area may be classified as either suspect or non-suspect depending on the potential for contamination.

Building Surfaces and Structures

Suspect Affected Areas

The final survey of affected suspect areas includes a scan of 100% of accessible surface area and a minimum of 30 measurements per survey unit for removable activity (smears), total activity (fixed point measurements) and exposure rate. The location of these measurements will ensure uniform coverage of the area and the investigation of potentially elevated areas of activity identified during the scan survey.

It is intended that only portions of suspect affected areas be gridded due to the large number of obstructions and non-uniform surfaces. If the area is gridded, measurements will be taken at each grid intersection. Where survey units are not gridded, the number of measurement locations will be based in part on the size of the area being surveyed. To ensure adequate coverage in survey units that are not gridded, the following measurement frequencies have been established.

For areas ≤ 20 square meters	A minimum of 30 measurement locations
For areas > 20 square meters	Equivalent to 1 meter intervals

Non-suspect Affected Areas

The final survey of non-suspect affected areas above 2 meters includes a minimum of 30 measurements per survey unit for removable activity, total activity and exposure rate, and a scan survey of the accessible surfaces at each measurement location. In general, these areas will not be gridded. Measurement locations will be selected from locations most likely to accumulate contamination and the investigation of potentially elevated areas of activity identified during the scan. If activity in excess of 50% of the guideline value for average total activity or removable activity is verified in a non-suspect affected area, the area will be classified as a suspect affected area and resurveyed. The number of measurement locations will be based in part on the size of the area being surveyed.

For areas ≤ 600 square meters	A minimum of 30 measurement locations
For areas > 600 square meters	A minimum of 1 measurement location for each 20 square meters surveyed

Unaffected Areas

The final survey of unaffected areas includes a scan of approximately 10% of the accessible surface area comprising floors and walls below 2 meters, and a minimum of 30 measurements per survey unit for removable activity, total activity, and exposure rate. In general, these areas will not be gridded. Measurement locations will ensure uniform coverage of the area and the investigation of potentially elevated areas of activity identified during the scan. If activity in excess of 25% of the guideline values for average total activity or removable activity is verified in an unaffected area, the area will be classified as a suspect affected area and resurveyed. The number of survey locations will be based in part on the size of the area being surveyed.

For areas ≤ 1500 square meters	A minimum of 30 measurement locations
For areas > 1500 square meters	A minimum of 1 measurement location for each 50 square meters surveyed

It is expected that the final survey of building exteriors will be in accordance with the protocol established for unaffected building surfaces and structures.

Plant Systems

Plant systems will be classified as either affected or unaffected. The exterior surfaces of plant system components will be surveyed in accordance with the protocols for building structures.

Affected Plant Systems

The final survey of the interior surfaces of affected plant systems will include a scan survey of approximately 25% of the accessible surface within each system, and a minimum of 30 measurements of removable activity and total activity within each survey unit. Measurement locations will be selected from locations where activity is most likely to accumulate. If appropriate, sampling and analysis of scale and sediment will be performed. Gamma exposure rate measurements will be limited to interior surfaces of tanks and large vessels. A survey unit may be defined so as to include an entire affected system. However, a survey unit will typically not include more than one system.

Unaffected Plant Systems

The final survey of the interior surfaces of unaffected plant systems will include a minimum of 30 measurements within each system of removable activity, total activity and scan survey to be performed in the immediate vicinity of the measurement. Measurement locations will be selected from locations where activity is most likely to accumulate. If appropriate, sampling and analysis of scale and sediment will be performed. Gamma exposure rate measurements will be limited to tanks and large vessels. If activity in excess of 25% of the guideline values for average total activity or removable activity is verified in unaffected plant systems, the system will be reclassified as affected and resurveyed. A survey unit may be defined so as to include an entire unaffected system. However, a survey unit will typically not include more than one system.

Open Land Areas

Open land areas will be classified as affected or unaffected. Open land areas included in the final survey are the restricted area and the area adjacent to the liquid effluent pathways. The final survey for open land areas with paved surfaces will be in accordance with the protocols established above for building surfaces and structures.

Affected Open Land Areas

The final survey of affected open land areas without paved surfaces includes a gamma exposure rate scan survey of 100% of the accessible surface area, and a minimum of 30 exposure rate measurements and surface soil samples per survey unit. These areas will normally be gridded into 10 meter by 10 meter, or 5 meter by 5 meter grids. Soil samples collected within each 10 meter by 10 meter grid will be from locations equidistant between the center and each of the 4 corners. Within each 10 meter by 10 meter grid, 4 soil samples will be collected and an exposure rate measurement will be made at 1 meter from the surface at the location of the soil samples. Soil samples collected within each 5 meter by 5 meter grid will be from the center of each grid. Within each 5 meter by 5 meter grid, 1 soil sample will be collected and an exposure rate measurement will be made at 1 meter from the surface at the location of the soil sample. The location of these measurements will ensure uniform coverage of the area and the investigation of potentially elevated areas of activity identified during the scan. The number of measurement locations within each survey unit will be based in part on the number of grids in the area.

If activity is verified in excess of 75% of a guideline value, additional samples will be collected to determine the extent of the activity.

For areas ≤ 750 square meters

A minimum of 30 measurement locations is required

For areas > 750 square meters

A minimum of 4 measurement locations are required for each 100 square meters being surveyed

The final survey of the liquid effluent pathway will consist of representative soil and sediment samples. The open land areas adjacent to the liquid effluent pathway will be surveyed in accordance with protocols established for unpaved surfaces within affected open land areas.

Unaffected Open Land Areas

The final survey of unpaved surfaces in unaffected areas will include a gamma exposure rate scan survey of approximately 10% of the accessible surface area and a minimum of 30 exposure rate measurements and surface soil samples. If activity in soil is verified in excess of 25% of a guideline value, the area will be classified as affected and resurveyed. It should be noted that it may not be possible to scan or take exposure rate measurements at 25% of the applicable guideline value due to significant background interference.

In general these areas will not be gridded, however measurement locations will be marked. The measurement locations will ensure uniform coverage of the area and the investigation of potentially elevated areas of activity identified during the scan. The final survey of settling ponds will consist of gamma spectral analysis of representative sediment samples.

The related sections of the survey plan will be revised to include detailed descriptions of the grid system to be used, frequency of measurements, survey unit size and surface area represented by each measurement.

NRC General Comment #2:

The plan proposes to use a value of 50% of the average limit as the action level for investigating contamination verified in unaffected areas, i.e., in areas where no contamination is expected. Please justify, based on technical and ALARA considerations, the use of the 50% investigation level as opposed to the 25% level recommended in NUREG/CR-5849.

PSCo Response: PSCo agrees that 25% of the guideline value for average total activity is an appropriate action level for investigation survey in unaffected areas due to the low measurement frequency prescribed for unaffected areas. The related sections of the survey plan will be revised to reference 25% of the guideline value for average total activity as the action level for investigation survey in unaffected areas.

In accordance with the response to General Comment #1:

- If activity in excess of 25% of the guideline value for average total activity or removable activity is verified in an unaffected area associated with building surfaces and structures or plant systems; or,
- If activity in excess of 25% of a guideline value is verified in soil or sediment samples from an unaffected open land area; or
- If activity in excess of 50% of the guideline value for average total activity or removable activity is verified in a non-suspect/affected area associated with building surfaces and structures, the area will be classified as an affected area (suspect affected for building surfaces and structures) and resurveyed.

For unaffected areas, the count times associated with measurements for total activity (fixed point measurements), removable activity (smears) and gamma spectral analysis (soil and sediment samples) will be adjusted as required to ensure an MDA of <25% of the applicable guideline value. It should be noted that it may not be possible to scan or take exposure rate measurements at 25% of the applicable guideline value due to significant background interference.

For non-suspect affected areas, 50% of the guideline value has been proposed as an action level for investigation survey. The justification for using 50% of the guideline value as the action level for investigation in non-suspect affected areas is: (1)the reduction in the beta-gamma activity limits for average total surface contamination and for removable surface activity in order to account for HTDN, (2)measurement locations are selected from surfaces most likely to accumulate contamination, (3)although it is probable that low levels of residual activity have accumulated in overhead areas during power operation and decommissioning, there is a much lower probability of residual activity being present in excess of guideline values in overhead areas than for the floor and lower wall surfaces, and (4)the minimum sampling frequency for non-suspect affected areas will be 1 measurement location per 20 square meters versus 1 measurement location per 50 square meters in unaffected areas, and measurement locations will

be selected from surfaces most likely to accumulate contamination. This measurement frequency, and the selection of measurement locations from surfaces most likely to accumulate contamination, will serve to adequately identify areas requiring investigation survey.

Additionally, the use of 25% versus 50% of the guideline value for average total activity as an action level for investigation in non-suspect affected areas requires an MDA of $\leq 25\%$ of the guideline value for average total activity. For the limited number of measurements collected from within unaffected areas, the count times will be increased by approximately a factor of 3 to achieve the required detection sensitivity. In consideration of the increased survey measurement frequency for non-suspect affected areas, to increase the count times by a factor of 3 would have a significant impact upon the number of personnel required to perform the survey within the current project schedule.

NRC Specific Comment #1:
(Preface)

The preface states that revisions to the survey plan will be controlled in accordance with 10 CFR 50.59. There are certain parts of the plan that should not be changed without prior NRC staff review such as the survey frequency, action levels for conducting investigations and followup surveys, and the statistics for demonstrating that the unrestricted use criteria have been met. Please describe which aspects of the plan may be modified through the 50.59 process.

PSCo Response: The second paragraph of the Preface of the FSV Final Survey Plan, Revision 0 will be revised as follows:

"This plan has been developed as administrative guidance. It is intended to provide the basis for the implementing procedures governing the conduct of the final survey. Revisions to this plan may be implemented without prior NRC approval provided the changes do not:

- Involve an unreviewed safety question as defined in 10 CFR 50.59 and do not require a change in the Decommissioning Technical Specifications,
- Reduce the required survey frequency for the classification of the survey unit,
- Increase the action levels for conducting investigation and followup surveys, or
- Affect the statistical treatment of survey data in a manner which could reduce the confidence that the site meets the criteria for unrestricted use."

NRC Specific Comment #2:
(Page 3-8, Section 3.3.6)

NUREG/CR-5849 recommends a maximum exposure rate from building surfaces of 2 times the average limit; for building surfaces this translates to 10 $\mu\text{R/hr}$. Please provide additional detail regarding Administrative Action Level 7, which appears to allow maximum exposure rates in excess of 10 $\mu\text{R/hr}$ above background.

PSCo Response: As previously defined, Administrative Action Level 7 could have allowed individual exposure rate measurements to exceed the estimated background exposure rate for a survey unit by more than 10 $\mu\text{R/hr}$. The intent of the additional criterion related to the 99.9% confidence level of the background exposure rate was to minimize the need for follow-up evaluations purely due to statistical variation.

Administrative Action Level 7 will be revised to remove the criterion that individual exposure rates exceed the 99.9% confidence level of the background exposure rate.

"Level 7: Individual exposure rate measurements greater than 10 $\mu\text{R/hr}$ above background."

The estimated background exposure rate for a survey unit is assumed to be equal to the mean exposure rate for a survey unit. There may be a small contribution to some of the individual exposure rate measurements from a survey unit due to licensed material, however the amount of licensed material, and subsequently the contribution to the mean exposure rate, will be limited by the acceptable levels of surface activity. The resulting error in estimating the background exposure rate using these measurements is small (2-3 $\mu\text{R/hr}$) when compared to other sources of uncertainty in estimating the background exposure rate for a survey unit. The true background exposure rate for a survey unit is dependent on many factors such as building materials, construction techniques, size, soil composition, elevation, instrument response, atmospheric conditions, etc.

Although not likely, there is a small possibility that licensed material could be present such that it causes a uniform increase in each of the individual exposure rate measurements from a survey unit. If this were to happen, and the measurements for removable and total activity failed to identify the presence of licensed material, using the mean exposure rate to estimate the background exposure rate could result in the presence of licensed material not being identified. To minimize the possibility of this occurring, Administrative Action Level 8 will be revised to add the criterion that individual exposure rate measurements for building surfaces which exceed 30 $\mu\text{R/hr}$ will be investigated. Based upon the results of preliminary gamma exposure rate measurements collected from various unaffected locations within the facility, 30 $\mu\text{R/hr}$ is an appropriate gamma exposure rate action level to warrant investigation.

Administrative Action Level 8 will revised as follows:

"Level 8: Gamma exposure rate measurements greater than 5 $\mu\text{R/hr}$ above background or greater than 30 $\mu\text{R/hr}$."

A technical basis supporting this method of estimating the background exposure rate has been developed and is available for NRC review.

NRC Specific Comment #3:

(Page 3-12, Section 3.8)

Are the exterior surfaces of systems included in survey units for systems or building interiors?

PSCo Response: The external surfaces of plant system components will be considered structures and will be included in the grouping of survey units for building interiors. This is based upon the assumption that in most instances, the external surfaces of plant system components will have a potential for contamination similar to the building surfaces where they are located. Examples of these external surfaces which will be included in building interior survey units are ventilation ductwork, process piping, valves, pumps, instrumentation and other process system components.

The internal surfaces of plant system components are affected primarily by process operations and therefore will be included in a grouping of survey units for plant systems separate from structure survey units.

Page 3-12, Section 3.8 will be modified as follows:

"Three categories or types of survey areas have been established including:

- Structures, to include building interiors and exteriors, and the exterior surfaces of plant system components,
- Plant systems, to include the interior surfaces of process piping and components and ventilation ductwork, and
- Outdoor areas, to include facility grounds and the liquid effluent pathway."

NRC Specific Comment #4:

(Page 4-3, Table 4.1)

How will the area correction factors be applied for detectors with areas greater than 100 cm² to calculate dpm/100 cm²?

PSCo Response: For reporting purposes, the net activity observed in dpm/100 cm² is calculated as follows:

$$dpm/100\text{ cm}^2 = ((Gross\ Cts/Sec*60-bkg)/Eff/Area*100)-BKG_i$$

where:

<i>Gross Cts</i>	=	The observed counts for the counting interval,
<i>Sec</i>	=	The counting interval in units of seconds,
<i>bkg</i>	=	The local area background at the time of the survey, obtained with a shielded detector, accounting for instrument noise, ambient exposure rate, cosmic radiations, etc., expressed in units of counts per minute,
<i>Eff</i>	=	The efficiency of the detector in units of cpd as measured with uniformly distributed source material,
<i>Area</i>	=	The area of the detector face in units of square centimeters.
<i>BKG_i</i>	=	The term that accounts for the naturally-occurring radioactive material associated with the surface being surveyed, expressed in units of dpm/100 cm ² . This term is dependent upon the type of material being surveyed. This term may be conservatively set to equal zero.

Additional considerations are necessary when using detectors with areas significantly greater than 100 cm². (for example, 300 cm² or 550 cm²) It is assumed that the activity observed per detector area could be non-uniformly distributed and limited to an area of less than 300 cm² or 550 cm². When using these detectors, the scaler and/or rate meter alarm setpoints are reduced by the ratio of the detector area divided by 100 cm². In the event that activity is observed at levels which exceed the reduced alarm setpoints for large area detectors, additional measurements are performed using small area detectors in order to ensure the activity does not exceed guideline values.

NRC Specific Comment #5:

(Page 4-4, Table 4.2)

- a.) Please describe the equations for determining MDAs for both scan and stationary surveys.
- b.) Will the results greater than the "critical level", as described in Currie, L.A. (1968), "Limits for qualitative detection and quantitative determination - application to radiochemistry," Anal. Chem. 40, 586., be reported as positive?
- c.) Under what conditions will the Ludlum 44-40 be used for stationary and scan surveys? The MDA for scan surveys exceeds the 75% threshold discussed in Section 4.3.5.

PSCo Response:

- a.) The MDA is determined for stationary field survey measurements using the SEG CNTTIME® computer program. The MDA for scan survey can also be estimated in this manner by defining the sample counting time (ts) as the interval of time that a point of interest would reside beneath the sensitive area of the detector.

$$MDA_{(dpm/100cm^2)} = \frac{(z(1-a) * z(b) + [z(1-a) + z(b)] * (R_b * t_s * (1 + t_s/t_b))^{0.5}}{Eff * t_s * Area / 100}$$

Where:

$z(1-a)$ = z score for probability of wrongly identifying background as the limit, (1.645 for 95% probability)

$z(b)$ = z score for probability of not detecting activity when it is present at the limiting value, (1.645 for 95% probability)

R_b = background count rate, including instrument noise, ambient exposure rate, cosmic radiations and naturally-occurring radioactive material, (counts per minute)

t_b = counting time for background, (minutes)

t_s = sample counting time, (minutes)

Eff = counting efficiency, (c/d)

Area = area of the detector, (square centimeters)

The MDA for laboratory counting instrumentation is determined using the following equation:

$$MDA = \frac{\frac{2.71}{t_s} + 3.29 \sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E}$$

Where:

MDA = the minimum amount of activity that can be statistically detected above background with a 95% probability and with a maximum of 5% probability of falsely interpreting background activity as activity due to contamination (dpm/100 cm²),

R_b = the background count rate in counts per minute (cpm),

t_s = sample counting time (minutes),

t_b = background counting time (minutes),

E = the counting efficiency, (c/d).

- b.) For surface activity measurements, a graphical illustration indicating the critical level will be provided in addition to summary statistics for each survey unit. After conversion to units of cpm/100cm², the critical level will be calculated as follows:

$$L_c = \frac{1.645 \sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E}$$

Where:

L_c = the minimum amount of activity that can be statistically detected above background with a 95% probability (dpm/100 cm²),

R_b = the background count rate in counts per minute (cpm),

t_s = sample counting time (minutes),

t_b = background counting time (minutes),

E = the counting efficiency, (c/d).

The critical level will be represented on the graphical illustration as a horizontal line, defining those measurements above and below the critical level. This presentation will facilitate rapid review to identify measurement values above or below the critical level.

- c.) It is the intent of PSCo to use the Ludlum 44-40 Geiger-Mueller detector only when size constraints will not allow the use of larger detectors. The information obtained while performing scan surveys with the Ludlum 44-40 is useful for identifying areas of elevated activity, however due to the limitations of the detection sensitivity when used for this application, it is not the detector of choice for scan survey measurements.

NRC Specific Comment #6:
(Page 4-6, Section 4.3.1)

Under the definition of affected area, the plan states that all floors and lower walls in affected areas will be classified as suspect, and that upper walls and ceilings in affected areas may be classified as suspect or non-suspect, depending on the expected contamination level. This appears to be inconsistent with Figure 4.1, which indicates that the lower walls and floors may be classified as non-suspect, and surveyed with a lower frequency.

PSCo Response: Figure 4.1, Survey Unit Classification Process will be revised to clarify that all floors and lower walls in affected areas will be classified as suspect and scanned over 100% of the accessible surface. A detailed description of survey protocol for affected area floors and lower walls can be found in General Comment #1.

NRC Specific Comment #7:

(Page 4-12, Section 4.3.6)

- a.) Describe in detail the grid size and frequency of measurements in affected and unaffected areas.
- b.) Also, describe in detail under what conditions the scan surveys would provide reproducible and statistically acceptable data similar in quality to that obtained from direct measurements.

PSCo Response:

- a) The grid size and frequency of measurements in affected and unaffected areas is discussed in the response to General Comment #1. Only survey units containing suspect affected building surfaces, or containing affected open land areas are expected to be gridded. A minimum number of measurement locations are specified for each survey unit. The minimum number of measurement locations is in part a function of the size of the survey unit.
- b) At present, scan surveys have not been proven to provide reproducible and statistically acceptable data, similar in quality to that obtained from direct measurements. Work in this area centers around the use of microprocessor-based survey instruments. If developments warrant, the results of this work will be presented as justification for reducing the required number of stationary measurements for total surface contamination.

NRC Specific Comment #8:
(Page 4-12, Section 4.3.6)

NRC recommends that FSV report the additional measurements performed to determine if areas containing contamination in excess of the average limit (elevated areas) meet the hot-spot criteria.

PSCo Response: All measurement results used to demonstrate that the site meets the guideline values for unconditional release for unrestricted use will be presented in a final report including those used to demonstrate compliance with the average guideline value for total activity.

Individual measurement results for total activity and exposure rate will be compared against the average and the maximum guideline values (i.e., hot-spot criteria). Measurement results less than the average guideline value will be deemed acceptable. Measurement results greater than the maximum guideline value will indicate the need for remediation. Measurement results greater than the average guideline value but less than the maximum guideline value will require investigation to determine if the average of a series of measurements collected from one square meter for total activity, or 10 square meters for exposure rate, exceeds the average guideline value.

NRC Specific Comment #9:
(Page 4-13, Section 4.3.7)

The exposure rate limit is intended to be applied at one meter from any surface, including corners and adjacent surfaces. The contribution from naturally-occurring radioactive materials should be accounted for in the background determination. Provide additional justification for performing exposure rate measurements at distances greater than 1 meter.

PSCo Response: Section 4.3.7 will be revised to indicate that exposure rate measurements will be taken at 1 meter from accessible surfaces and compared to the estimated background exposure rate. Individual exposure rate measurements which exceed the estimated background exposure rate by more than 5 $\mu\text{R/hr}$ will require further investigation to establish the average and maximum exposure rates in the area. If these exposure rates exceed the guideline values, and the cause is determined to be the result of structural configurations, a notation will be made in the survey record. If these exposure rates exceed the guideline values, and the cause is determined to be the result of licensed material, remediation will be required.

NRC Specific Comment #10:
(Page 4-16, Section 4.4.3.f)

At the bottom of page 4-16 the plan states that "Since it will have been demonstrated that there is no residual activity above the Administrative Action Levels, the mean of the set of individual gamma exposure rate measurements of the survey unit represents the best estimate of the local background for the survey unit." If beta contamination is known to be present at levels exceeding background in a given area, but less than the Administrative Action Levels (which are up to 75% of the average and maximum limits), why are the exposure rate measurements in this area assumed to be the "best estimate" of background for the survey unit?

PSCo Response: It is intended that the background exposure rate for a survey unit will be estimated as the mean exposure rate for the survey unit. Although there may be a small contribution (2-3 $\mu\text{R/hr}$) to some of the individual exposure rate measurements within a survey unit due to licensed material, the resulting error in estimating the background exposure rate using these measurements is small when compared to other sources of uncertainty in determining the background exposure rate for a survey unit. The true background exposure rate for a survey unit is dependent on many factors such as building materials, construction techniques, size, soil composition, evaluation, instrument response, atmospheric conditions, etc.

It is unlikely that a survey unit would have activity present at levels approaching 75% of the site specific guideline value for average total activity. This assumption is supported by the results of survey at the Army Materials Technology Laboratory and the Shoreham Nuclear Generating Station. However, based on the nuclide mix, if activity was present at 75% of the site specific guideline value for average total activity, it is estimated that it would cause a 2-3 $\mu\text{R/hr}$ increase in the exposure rate. The estimate was developed assuming an infinite plane source. A 2-3 $\mu\text{R/hr}$ error associated with estimating the background exposure rate for a survey unit is not considered significant when compared to the uncertainty associated with estimating the background exposure rate from measurements taken outside of the survey unit. The error associated with estimating the background exposure rate as the mean exposure rate for the survey unit will be minimal.

A technical basis supporting this method of estimating the background exposure rate has been developed and is available for NRC review.

NRC Specific Comment #11:
(Page 4-17, 4.4.3.h)

Equation 4.2 should be used to verify the adequacy of all background values, not only those values exceeding 10% of the release limit. Equation 4.2 is intended to ensure that the variability of all background values selected are not too large.

PSCo Response: In accordance with Draft NUREG/CR-5849, Section 8.6, Pages 8.15 and 8.16, the Final Survey Plan indicates that "For background soil and water samples where the activity for nuclides of interest exceeds 10% of the release limit at the 95% confidence level, the population of background measurements will be tested to ensure that the number of measurements in the data set is adequate to support the population statistics. The total number of background measurements required will be calculated as shown below:

$$n_i = \left[\frac{t_{95\%, df} s}{a \bar{x}} \right]^2$$

where:

- n_i = number of measurements required,
- $t_{95\%, df}$ = Student's t statistic for 95% confidence at $df = n-1$ degrees of freedom,
- df = $n-1$ degrees of freedom where n is the number of initial measurements,
- s = standard deviation of initial measurements,
- a = variable depending upon background variation, this value is typically 0.2,
- \bar{x} = mean of mutual determination when greater than, or equal to 10% of the release limit."

The derivation of this equation is based on a positive, non-zero value for \bar{x} and that the statistical approach is to use the value for n_i calculated by this method only if the background is a significant part of the signal to be measured. The use of all background sample results, including those indicating levels which are less than 10% of the activity limit, would require a potentially large number of samples to verify adequacy of the background samples.

NRC Specific Comment #12:

(Page 4-19, Figure 4.1)

UNAFFECTED AREA:

- a.) NUREG/CR-5849 recommends that the number of measurements in an unaffected area should be the larger of either 30 or 1 measurement/50 m² of surface area. What minimum sampling frequency will be applied for unaffected areas at FSV?
- b.) What investigation and additional measurements will be performed if contamination is identified in an unaffected area?

AFFECTED AREA:

- c.) Describe the procedure for performing the biased survey measurements. Will there be a minimum number of measurements?
- d.) Will the determination as to whether an area exceeds Action Level 1 be made based on individual measurements or an average?
- e.) Action Level 2 appears to be based on an average. Are individual measurement results considered when determining if an area should be suspect or non-suspect?
- f.) What investigations, remediation, and or additional sampling will be performed if a hot-spot is identified or a survey unit fails the release criteria?
- g.) Will additional measurements be performed if the final survey results indicate that a non-suspect affected area exceeds Action Levels 1 or 2?
- h.) It appears the FSV intends to scan survey 100% of affected/suspect ceilings and walls above 2m. 100% scan exceeds the level of effort recommended for scans in NUREG/CR-5849, which calls for at least 30 direct measurements of ceilings and upper walls and scans only in the immediate area surrounding the location of direct measurement (unless contamination exceeding 25% of the release limit is identified in the ceilings or upper walls). See Section 4.2.3 of NUREG/CR-5849.
- i.) Are direct measurements planned for upper walls and ceilings of affected areas?
- j.) Will additional direct measurements be collected at locations where the scan surveys indicate contamination above background?
- k.) What is the maximum size of the survey units to be selected for suspect and non-suspect areas? For affected areas, NUREG/CR-5849 recommends a maximum size of 100 m² for building surface survey units. If a survey unit is proposed to be larger than 100 m², what is the maximum area that will be represented by each measurement in unaffected, affected/suspect, and affected/non-suspect areas?

PSCo Response:

- a.) The final survey will be subdivided by survey units. Survey units will be classified as affected or unaffected. Regardless of a survey unit's classification, each survey unit must contain a minimum of 30 measurement locations. Unaffected building surfaces in excess of 1500 square meters require a minimum of 1 measurement location for each 50 square meters of surface area. There is no recommended minimum number of measurement locations as a function of surface area for unaffected open land areas without paved surfaces, however the frequency of measurement locations will ensure 30 measurement locations per survey unit. Additional measurement locations in these areas may be specified on a case by case basis.
- b.) If activity in excess of 25% of the guideline value for average total activity or removable activity is verified in an unaffected survey area associated with building surfaces and structures and plant systems; or if activity in excess of 50% of the guideline value for average total activity or removable activity is verified in a non-suspect/affected area; or if activity in excess of 25% of a guideline value is verified in an unaffected open land area, the survey unit will be reclassified as affected (suspect affected for building surfaces and structures) and resurveyed.
- c.) The intent of the biased turnover survey is to identify and concentrate on areas with greatest potential for residual contamination and to ensure that an area classified as affected is ready for final survey. The number of measurements performed during the survey will generally be based on the professional judgement of the individual performing the survey, although no minimum number of measurements has been established. This survey will include as a minimum, measurements for total and removable activity.
- d.) The results of each individual measurement for removable activity will be compared to action level 1. Administrative action level 1 will be based on 25% of the guideline value for removable activity for unaffected survey units, and 50% of the guideline value for removable activity for non-suspect affected survey units.
- e.) Individual measurements will be compared to the guideline value for average total activity. This comparison may aid in the initial classification of a survey unit as affected or unaffected and will be a criterion by which a survey unit may be reclassified and resurveyed. Figure 4.1 and administrative action level 2 will be revised to indicate that a single measurement in excess of 25% of the guideline value for average total activity in an unaffected area; or a single measurement in excess of 50% of the guideline value for average total activity in a non-suspect affected area will serve as an initiator for investigation surveys. Pending the result of investigation surveys, unaffected areas or non-suspect affected areas may be classified as suspect affected areas if activity is verified in excess of Action Level 2.

- f.) If an individual measurement for total activity exceeds the guideline value for average total activity but does not exceed the maximum guideline value for total activity, the immediate area will be gridded into 1 meter by 1 meter grids. A series of measurements for total activity will be collected from each grid and averaged. The average value for each grid as well as the individual measurements will be compared to the applicable guideline values. If any guideline value is exceeded including those for maximum total activity, removable activity or exposure rate, the area will be remediated and resurveyed.
- g.) If any individual measurement result from a non-suspect affected area exceeds 50% of the guideline value for average total activity or removable activity, investigation surveys will be performed. If measurement results are verified in excess of 50% of the guideline value for average total activity or removable activity, the area will be classified as suspect affected and resurveyed.
- h.) Walls above 2 meters and ceilings classified as suspect affected will require a scan of 100% of the accessible surface area. Walls above 2 meters and ceilings classified as non-suspect affected or as unaffected will require a scan in the immediate vicinity of each measurement location.
- i.) A minimum of 30 measurement locations are required in each survey unit. Walls above 2 meters and the ceiling of a given room would typically be included in a single survey unit. The exact number of measurement locations required in a survey unit depends on classification and size. For building surfaces, measurements for removable activity, total activity and exposure rate are required at each measurement location.
- j.) Areas of elevated activity identified during the scan will be investigated. The location of elevated activity will be marked on the surface. If elevated activity exceeds the guideline value for average total activity but does not exceed the maximum guideline value for total activity, the immediate area will be gridded into 1 meter by 1 meter grids. A series of measurements for total activity will be collected from each grid and averaged. The average value for each grid as well as the individual measurements will be compared to the applicable guideline values. If elevated activity exceeds the guideline value for maximum total activity, the area will be remediated.
- k.) Since survey units are designed to be contiguous areas with similar characteristics and contamination potential the actual size of a survey unit is not deemed to be critical if each survey unit contains a sufficient number of measurement locations. The minimum number of measurement locations as a function of survey unit classification is provided in the response to General Comment #1.

NRC Specific Comment #13:
(Page 5-1, Section 5.1.1)

- a.) Under what conditions will the background values be deemed inappropriate, and what followup actions and investigations will be performed if such a finding is made?
- b.) Will SEG spreadsheet program, CNTTIME, be used to demonstrate compliance with the unrestricted use limits or will Equation 5.1 be used?
- c.) Please describe the calculations used in the CNTTIME program to determine if a set of measurements statistically exceeds an Action Level.
- d.) Will negative numbers be reported and used in the statistical analysis?

PSCo Response:

- a.) The background values associated with the final survey program will be continuously evaluated. For example, the result of assigning a background value which was inappropriately high could result in the majority of the measurements within a given survey unit being negative. Net measurement results skewed low will be evident when reviewing the graphical presentation and summary statistics for each survey unit.

The investigation will include the collection of additional measurements within the survey unit, a verification that dissimilar construction materials are not the cause of inconsistent measurement results, and a comparison of the survey measurement results to previous measurement results from surfaces of similar construction in unaffected areas.

If any background values are determined to be inappropriate they will be adjusted as necessary. All adjustments, and the justification for such adjustment, will be documented to ensure traceability.

- b.) Equation 5.1 will be used to demonstrate compliance with the guideline values after the individual survey measurements have been compared to the guideline values. The CNTTIME spreadsheet is used to calculate the MDA for stationary measurements.
- c.) Final survey database software developed by SEG converts raw counts to activity in units of dpm/100 cm² taking into account variables such as background, detector efficiency, detector size and count time. The software identifies results that exceed a preset action level and calculates average activities. A manual review prior to sign-off of a hard copy of the results will identify results that exceed an action level.
- d.) All measurements results, both positive and negative will be graphically presented and included in the summary statistics for the survey unit. Inclusion of only positive results, i.e., only those greater than the critical level, would bias the statistics for the survey unit.

NRC Specific Comment #14:
(Page 5-2, Section 5.2.1)

- a.) The 15,000 dpm maximum limit applies to any hot-spot with an area of 100 cm² or less. Please verify that the statement in parenthesis, i.e., "surface area not to exceed 100 cm²," conforms to this definition.
- b.) Describe the "equivalent" to Equation 5.1 that may be used in place of Equation 5.1 to demonstrating (sic) compliance with the total surface activity limits.

PSCo Response:

- a.) "Not to exceed 15,000 dpm/100 cm² (surface area not to exceed 100 cm²)", is intended to be equivalent to "the 15,000 dpm maximum limit applies to any hot-spot with an area of 100 cm² or less".
- b.) The term "equivalent" will be deleted. Initially, individual contamination measurements will be compared to guideline values. The 95% confidence level (single-tailed distribution)¹ will be used to further demonstrate attainment of the release limits once the individual measurements have demonstrated compliance with the guideline value. Section 5.2 will be revised as follows:

5.2.1 Attainment of Release Limits for Surface Contamination

a. Total Surface Activity (fixed plus removable contamination):

Individual measurements: Not to exceed 15,000 dpm/100 cm² or the related site-specific guideline value (surface area not to exceed 100 cm²).

Average measurements: Not to exceed 5000 dpm/100 cm² or the related site-specific guideline value when averaged over 1 m².

b. Removable Surface Contamination:

Individual measurements: Not to exceed 1000 dpm/100 cm², or the related site-specific guideline value.

¹ The confidence interval is calculated using Normal statistics (one-tailed distribution) at the 95% confidence level with alpha = 0.05. Alpha denotes the probability of a false-negative conclusion.

5.2.2 Attainment of Gamma Exposure Rate Limit

Individual measurements:	Net gamma exposure rate not to exceed 10 $\mu\text{R/hr}$ above natural background and not to exceed 30 $\mu\text{R/hr}$.
Average measurement - buildings	Gamma exposure rate not to exceed 5 $\mu\text{R/hr}$ above natural background when averaged over not more than 10 m^2 .
Average measurement - environs	Gamma exposure rate not to exceed 5 $\mu\text{R/hr}$ above natural background when averaged over not more than 100 m^2 .

5.2.3 Attainment of Soil and Water Limits

Sampling and analysis will be performed using approved procedures as described in Section 4.3.8. The analysis results for individual samples will be compared to the background levels as determined in Section 4.4.3.e.

The TEDE for the average concentrations of radioactive materials above background in soil and water will be determined in accordance with the methodology contained in NUREG/CR-5512, Volume 1, or through the use a similar methodology, such as that contained in the RESRAD Modelling Program, to assure that the total effective dose equivalent could not exceed 10 mrem during a period of one year.

5.2.4 Attainment of HTDN Limits

A limited number of samples will be collected from facility surfaces, structures and systems to determine the relative fractions of HTDN. The relative fractions will be used to calculate an appropriate Site-Specific Guideline Value for average total activity and removable activity for typical beta-gamma emitting nuclides. Compliance with the Site-Specific Guideline Value for beta-gamma emitting nuclides normally detected during field survey will ensure that levels of HTDN in residual surface contamination will be limited to the values approved for the Fort St. Vrain site.

5.2.5. Calculation of the 95% Confidence Level of the Mean for a Survey Unit:

$$U_u = \bar{X} + t_{1-\alpha, df} \frac{S_x}{\sqrt{n}}$$

where:

U_u = upper confidence limit of sample mean

\bar{X} = sample mean value

$t_{1-\alpha, df}$ = student t statistic for the degree of confidence and degrees of freedom; df (degrees of freedom) is equal to $n - 1$; and α is 0.05 for this test

S_x = estimate of the sample standard deviation

n = number of measurements in the survey unit

NRC Specific Comment #15:
(Page 5-4, Section 5.2.2)

- a.) Please clarify whether or not exposure rates greater than the 10 $\mu\text{R/hr}$ above background maximum criteria will be investigated if they are less than the 99.9th percentile of the "distribution of individual measurements?"
- b.) What is the basis for selecting 99.9%?
- c.) Does the "distribution of individual measurements" include all of the measurements in the survey unit?
- d.) Will "Type 2" error be limited to ensure with a set confidence level (for example, 95%) that the exposure rate does not exceed a certain maximum level?
- e.) At what point will FSV evaluate the need to reassess the background value selected for a given area?
- f.) Regardless of the investigation level ultimately set for individual exposure rate measurements, the average should be less than the 5 $\mu\text{R/hr}$ at 95% confidence.

PSCo Response:

- a.) Exposure rate measurements which exceed the background exposure rate, as estimated from the mean exposure rate for the survey unit by more than 5 $\mu\text{R/hr}$ will require investigation to establish the average and maximum exposure rates.
- b.) The intent of the additional criterion related to the 99.9% confidence level of the background exposure rate was to minimize the need for follow-up evaluations due purely to statistical variation. Administrative Action Level 7 will be revised to remove the criterion that individual exposure rates must exceed the 99.9% confidence level of the background exposure rate.
- c.) The "distribution of individual measurements" will include all of the measurements in the survey unit.
- d.) The 95% confidence level of the mean will be calculated for each type of measurement performed in a given survey unit to demonstrate compliance with guideline values.
- e.) The background values associated with the final survey program will be continuously evaluated. For example, the result of assigning a background value which was inappropriately high could result in the majority of the measurements within a given survey unit being negative. Net measurement results skewed low will be evident when reviewing the graphical presentation and summary statistics for each survey unit.

The investigation will include the collection of additional measurements within the survey unit, a verification that dissimilar construction materials are not the cause of inconsistent measurement results, and a comparison of the survey measurement results to previous measurement results from surfaces of similar construction in unaffected areas.

If any background values are determined to be inappropriate they will be adjusted as necessary. All adjustments, and the justification for such adjustment, will be documented to ensure traceability. Additionally, individual gamma exposure rate measurements for building surfaces which exceed 30 $\mu\text{R/hr}$ will be investigated.

- f.) The 95% confidence level of the mean exposure rate will be calculated for each survey unit and compared to 5 $\mu\text{R/hr}$ above the background.

NRC Specific Comment #16:
(Page 5-4, Section 5.2.3)

It is inappropriate to state that the TEDE may be as high as 3 times the limit (30 mrem) in certain small areas. The purpose of the averaging protocols are to ensure that the TEDE does not exceed the limit (10 mrem in this case) based on an evaluation of reasonably conservative exposure scenarios.

PSCo Response: Page 5-4, Section 5.2.3 will be modified as follows:

"... Samples indicating the presence of licensed materials in excess of 2 pCi/g above the natural background will be evaluated using the methodology contained in NUREG/CR-5512, Volume 1, or an equivalent methodology such as RESRAD, to ensure that the annual TEDE will not exceed 10 mrem. Individual samples may contain elevated concentrations, providing that the average concentration within contiguous area not to exceed 100 m² will result in an annual TEDE that does not exceed $(100/A)^{1/2}$ times the annual TEDE limit where A is the area of elevated activity in m²."

NRC Specific Comment #17:
(Page 5-4, Section 5.2.4)

The NRC Staff is reviewing an FSV request to raise the surface contamination limits for H-3 and Fe-55. If the request is approved, all of the sections (of the survey plan) dealing with HTDN's will require revision.

PSCo Response: In NRC letter dated June 15, 1994, "Approval of a Modification of Facility Release Criteria for Tritium and Iron-55 Surface Contamination at Fort St. Vrain Nuclear Generating Station", Public Service of Colorado was granted approval to modify the allowable total(fixed) surface contamination limits for tritium (H-3) and iron-55 (Fe-55). The total surface contamination limits were increased from the values which had been previously inferred from Regulatory Guide 1.86 to allow average total surface contamination up to 200,000 dpm/100cm², and maximum total surface contamination up to 600,000 dpm/100cm².

For affected survey units, the guideline values for average total activity and removable activity will be calculated using the following derivation of Equation A-2 in Draft NUREG/CR-5849, Appendix A, and using the acceptable levels of surface contamination from Regulatory Guide 1.86 and NRC Letter "Approval of a Modification of Facility Release Criteria for Tritium and Iron-55 Surface Contamination at Fort St. Vrain Nuclear Generating Station".

$$\text{Site-Specific Guideline Value} = \frac{F}{\left(\frac{f_1}{G_1} + \frac{f_2}{G_2} + \dots + \frac{f_n}{G_n} \right)}$$

Where:

Site-Specific Guideline Value = The acceptable level of surface contamination for nuclides normally detected during field measurement, adjusted for H-3, Fe-55 and other radionuclides not readily detectable.

f_i = Fraction of the total activity contributed by each nuclide,

G_i = Guideline value for each nuclide. (From Regulatory Guide 1.86 or as specified by the NRC),

F = Detectable nuclide fraction.

For affected survey units, analysis results of samples which are representative of the contamination which accumulated during power operation and decommissioning, and of the conditions expected at the time of final survey will be used for these calculations. In general, the calculated guideline values from a variety of samples collected within similar areas of the facility and having similar nuclide composition will be averaged to determine the appropriate guideline value for survey.

For unaffected structures and plant systems outside of the reactor building and radioactive waste processing areas, tritium and iron-55 are not considered to be nuclides of concern. In consideration of the absence of beta-gamma emitting nuclides in these areas, which is well-supported by the results of operational and decommissioning surveys, it is not reasonable to propose that tritium and iron-55 exist at measurable levels. For these surfaces, an adjustment to the release criteria for average total activity and removable contamination will generally not be performed. However, in the event that beta-gamma contamination is verified in excess of 25% the guideline, the surface will be reclassified as affected (suspect affected for building surfaces and structures) and resurveyed after any necessary adjustment to the release criteria has been made.

In consideration of the restrictive guideline value for removable beta-gamma contamination which will be calculated using the derivation of Equation A-2 in Draft NUREG/CR-5849, Appendix A, and the acceptable levels of surface contamination from Regulatory Guide 1.86 and NRC Letter "Approval of a Modification of Facility Release Criteria for Tritium and Iron-55 Surface Contamination at Fort St. Vrain Nuclear Generating Station", a modification to the acceptable levels of removable contamination due to tritium and iron-55 has been proposed via a separate submittal. Pending approval of this request, the related sections of the survey plan will be revised as appropriate.

A technical basis supporting this method to determine site-specific guideline values has been prepared and is available for NRC review.

NRC Specific Comment #18:
(Page 5-5, Figure 5.1)

- a.) The flow chart indicates that an individual, direct survey result could be between the average and the maximum limit but the survey unit would be acceptable if the average is less than the average limit. This does not provide a mechanism for ensuring that the average over 1m² is less than the average limit. Any individual result that exceeds the average limit should be investigated to ensure that the average over any contiguous 1 m² does not exceed the average limit.

What is the method for establishing a subunit that requires remediation and additional surveys?

- b.) Also, the final survey report should contain all results, including 1) additional measurements to determine if the 1m² average criteria is met, 2) results of measurements failing an average or maximum limit, and 3) the results following additional remediation.

PSCo Response: Figure 5.1 will be revised to illustrate the following:

- a.) If an individual measurement for total activity exceeds the guideline value for average total activity but does not exceed the maximum guideline value for total activity, the immediate area will be gridded into 1 meter by 1 meter grids. A series of measurements for total activity will be collected from each grid and averaged. The average value for each grid, as well as the individual measurements, will be compared to the applicable guideline values. If any guideline value is exceeded, including those for maximum total activity, removable activity or exposure rate, the area will be remediated and resurveyed.
- b.) All measurement results used to demonstrate that the site meets the guideline values for unrestricted use will be presented in a final report including those used to demonstrate compliance with the average guideline value for total activity. It is not intended that measurement results that do not demonstrate that the site meets the guideline values for unrestricted use will be included in the final report, unless remediation is unsuccessful and the measurement results are necessary to depict the condition of the site. Results of measurements collected in support of remediation will, however, be maintained in a permanent record and will be available for NRC review.

NRC Specific Comment #19:
(Page 5-6, Figure 5.2)

- a.) An unaffected area is one with a very low probability of contamination; for example, an administrative building. This low contamination potential is the basis for the recommendation in NUREG/CR-5849 that the survey frequency in unaffected areas be significantly reduced from the frequency recommended for affected areas. Since no contamination is expected in unaffected areas, NUREG/CR-5849 recommends the investigation of any individual measurement exceeding 25% of the average limit to determine the source and extent of the contamination. Please justify the use of Action Level 2, i.e., 50% of the average contamination limit.
- b.) From Table 4.2 of the survey plan, it appears that the MDAs for the instrumentation and methods proposed for unaffected area surveys exceed 25% of the average limit. Please address the MDA's listed in Table 4.2 in the response to the above paragraph.

PSCo Response:

- a.) PSCo agrees that 25% of the guideline value for average total activity is an appropriate action level for investigation survey in unaffected areas. The related sections of the survey plan will be revised to reference 25% of the guideline value for average total activity as the action level for investigation survey in unaffected areas.

If activity in excess of 25% of the guideline value for average total activity is verified in an unaffected survey area associated with building surfaces and structures and plant systems; or if activity is verified in excess of 50% of the guideline value for average total activity or removable activity in a non-suspect/affected area; or if activity is verified in excess of 25% of the guideline value in an unaffected open land area, the survey unit will be reclassified as affected (suspect affected for building surfaces and structures) and resurveyed.

- b.) The count times associated with measurements in unaffected areas for average total activity, removable activity and gamma spectral analysis will be adjusted as required to ensure an MDA of < 25% of applicable guideline value. It may not be possible to scan or take exposure rate measurements at 25% of the applicable guideline value due to significant background interference.

NRC Specific Comment #20:
(Page 5-7, Figure 5.3)

Will compliance with the release criteria be demonstrated at the 95 % confidence level?

PSCo Response: The 95 % confidence level of the mean will be calculated for each type of measurement performed in a given survey unit and will be compared to the guideline value in order to determine if a survey unit is acceptable for unconditional release for unrestricted use.

NRC Specific Comment #21:

(Page 5-8, Figure 5.4)

- a.) Please elaborate on the method for using the 99.9% Confidence Level in the decision process.
- b.) Also, Figure 5.4 indicates that Action Level 8 (average exposure rate $> 5 \mu\text{R/hr}$) will be used to determine compliance with the release criteria. Will this decision be made at the 95% confidence level?

PSCo Response:

- a.) The intent of the additional criterion related to the 99.9% confidence level of the background exposure rate was to minimize the need for follow-up evaluations due to purely statistical variations. Administrative Action Level 7 and Figure 5.4 will be revised to remove the criterion that individual exposure rates must exceed the 99.9% confidence level of the background exposure rate.
- b.) Individual gamma exposure rate measurements will be compared directly to the mean gamma exposure rate for the survey unit. Measurements exceeding $5 \mu\text{R/hr}$ (Action Level 8) above the mean will be investigated, and individual measurements exceeding $10 \mu\text{R/hr}$ (Action Level 7) above the mean will require remediation. Additionally, individual measurements for building surfaces which exceed $30 \mu\text{R/hr}$ will be investigated. Based upon the results of preliminary gamma exposure rate measurements collected from various unaffected locations within the facility, $30 \mu\text{R/hr}$ is an appropriate gamma exposure rate action level to warrant investigation.

The 95% confidence level of the mean will be calculated for each type of measurement performed within a given survey unit and will be compared to the guideline value in order to determine if a survey unit is acceptable for unconditional release for unrestricted use.

NRC Specific Comment #22:
(Page 5-9, Figure 5.5)

- a.) Please provide the method for calculating TEDE.
- b.) See Comment #16 regarding the use of 30 mrem TEDE as an Action Level.
- c.) Please provide additional explanation of Note #1.

PSCo Response:

- a.) The methodology referenced in the Decommissioning Plan, and in the Survey Plan for calculation of the annual TEDE due to residual licensed material in soil and water is NUREG/CR-5512, "Residual Radioactive Material From Decommissioning".

It is noted that the pathway scenario software for NUREG/CR-5512 is currently unavailable for use. In the event that this software is unavailable at the point in time when potential doses must be evaluated, a similar methodology, such as that contained in the RESRAD Modelling Program will be used.

Page 3-7, Section 3.3.5 of the Final Survey Plan will be modified as follows:

"The TEDE for the average concentrations of radioactive materials in soil and water will be determined in accordance with the methodology contained in NUREG/CR-5512, Volume 1, or through the use a similar methodology, such as that contained in the RESRAD Modelling Program, to assure that the total effective dose equivalent could not exceed 10 mrem during a period of one year."

- b.) Figure 5.5 will be revised. The activity message for comparison and the decision block referencing 3 times the Action Level 9 will be deleted. Areas having elevated activity in soil will be tested to ensure that the average concentration within the 100 m² contiguous area will result in an annual TEDE that does not exceed $(100/A)^{1/2}$ times the annual TEDE limit where A is the area of elevated activity in m².
- c.) In the event that activity is verified at levels which exceed Action Level 9, the analysis results of samples which are collected in support of remediation activities will be maintained in a permanent record, however these results will not be included as final survey data.

NRC Specific Comment #23:
(Page 6-3, Section 6.2.1)

The unrestricted use criteria must be met with 95% confidence for each survey unit. It appears that compliance will be tested for each major category and not the individual survey units. Please clarify.

PSCo Response: The 95% confidence level of the mean will be calculated for each type of measurement performed within a given survey unit and will be compared to the guideline value in order to determine if a survey unit is acceptable for unconditional release for unrestricted use. These calculations will be specific to a given survey unit, and will be presented along with other relevant statistics for the survey unit.

NRC Specific Comment #24:
(Page 6-4, Section 6.2.3)

The final survey report should include all individual results, from affected as well as unaffected areas, that exceed the critical level. If investigations and/or additional measurements are required, the pre- and post-investigation results should be reported.

PSCo Response: All measurement results used to demonstrate that the site meets the guideline values for unrestricted use will be presented in a final report. These measurement results will be presented graphically for each survey unit with summary statistics provided. All measurement results, both positive and negative will be included. A horizontal line will be imposed on the graphs indicating the critical level associated with the measurement set being displayed.

Control Measures For Survey

Since all decommissioning activities will not be complete prior to the start of final survey, measures will be implemented to protect survey units from contamination subsequent to final survey. In all cases, decommissioning activities creating a potential for the spread of contamination must be completed within each survey unit prior to final survey. Additionally, decommissioning activities which create a potential for the spread of contamination to adjacent survey units will be evaluated and controlled by the Final Survey Coordinator and the Radiation Protection Department.

Prior to collection of final survey data from specific survey unit(s) where there is potential for contamination subsequent to survey, implementation of personnel training, along with one or more of the following control measures, is required:

- Installation of barriers to control ingress and egress to repower construction areas,
- Installation of postings requiring personnel to perform contamination monitoring prior to clean area access,
- Locking entrances to non-vital clean areas of the facility,
- Installation of chain locks on valves and blind flanges in plant systems,
- Installation of tamper-evident labels.

After the completion of final survey within a contiguous area of the facility, routine smear surveys will be performed to identify conditions which could affect the final status. Based upon the results of routine monitoring, or in the instance of a potentially-contaminating event within a survey unit or group of survey units, an investigation survey may be performed.

The investigation survey will consist of a 10% re-survey of the survey unit(s), concentrating on areas of highest contamination potential. If the investigation survey indicates a significant change in the radiological status of the survey unit which exceeds the action levels appropriate for the initial classification of the survey unit, then additional measurement and/or reclassification and remediation may be necessary.

A description of potentially-contaminating events and the results of investigation surveys will be included in the final report.