INTERSTATE NUCLEAR SERVICES
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DL-092398-02

September 23, 1998

Mr. Bryan Parker
US Nuclear Regulatory Commission, Region II
101 Marietta Street, Suite 2900
Atlanta, GA 30323-0199

RE: Control No. 257886 - Additional Information for Decommission Plan - License No. 20-25222-01.

Dear Mr. Parker:

The following information is submitted in response to your letter dated July 24, 1998.

With regard to background radiation level determinations, INS does not plan on releasing the facility on the basis of such measurements. 25 millirem per year, the limiting dose rate, equates to less than 2.9 µR/hr, a dose rate which would be statistically indistinguishable from the area's true environmental background unaffected by licensed radioactive material at the INS facility. The area's true environmental background is in the range of 10 - 12 µR/hr at waist level over natural terrain. INS plans to release the facility on the basis of fixed and removable contamination levels. Background for fixed contamination surveys will be determined from surfaces of the same material known to be free of contamination; i.e., in areas of the facility (e.g., lunchroom) where radioactive material has never been present. Background for removable contamination surveys will simply be the instrument background.

INS will conduct a µR/hr survey to demonstrate general area dose rates are roughly uniform and consistent with the uncontaminated facility background. For direct radiation measurements in and around the facility, INS will utilize the true environmental background, if feasible. If use of the true environmental background level is not feasible, INS will either use background levels from clean areas of the facility or locate a building of similar construction and age for background determination.

INS intends to remove all contaminated discharge piping from INS property. Piping and associated components, which are not removed, if any, will be decontaminated and surveyed to the free release criteria. Water utilized in decontamination efforts, if any, will be collected, filtered, and monitored in accordance with all license conditions. Final surveys of any remaining components on INS property and the connection to the sanitary sewer system will involve the collection of smears and

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direct frisk surveys as well as radiation level measurements at accessible piping locations and connections. Accessible locations are expected to be representative of inaccessible locations due to the nature and source of potential contamination. Attached are copies of recent correspondence between INS and the Hampton Roads Sanitation District (HRSD).

The equation in section 4.3 of the decommissioning plan, used to develop guideline values for nuclides not specified in the referenced document, is based on relative risk. 10 CFR 20 Appendix B concentration values are based on potential doses due to intake of radionuclides. Accordingly, the calculation determines an appropriate concentration based on the relative risk methodology incorporated into the regulations.

INS retracts its statement regarding surveying of inaccessible sewer lines to twice the values specified in the NRC document, "Guidelines for Decontamination of Facilities and Equipment". Sewer lines will be surveyed to the same criteria as accessible surfaces specified in the "Guidelines for Decontamination of Facilities and Equipment".

INS notes that the equations presented in NUREG/CR-5849 (e.g. Equation 5-2, page 5.7) are generalized to include assumptions involving equal background and sample count time and 95% confidence in avoiding both Type I (false negative) and Type II (false positive) errors. The INS MDA calculation allows for input of different background and sample count times and confidence levels. The MDA calculation utilized by INS is presented in an attachment. Example instrumentation and typical data is presented below.

Removable Contamination Surveys - Ex.: Ludlum 2929 with 43-10-1 alpha beta/gamma probe			
BKG count time:	10 minutes:	Smear count time:	1 minute:
α BKG:	1 cpm	β/γ BKG:	60 cpm
α eff:	40%	β/γ eff:	20%
α MDA:	5.24 dpm	β/γ MDA:	81.24 dpm

Since smears will involve approximately 100 cm^2, the smear MDA's will be 6 dpm per 100 cm^2 alpha and 82 dpm per 100 cm^2 beta/gamma.

Fixed Contamination Surveys - Ex.: Ludlum Model 1000 with 44-9 pancake GM probe			
BKG count time:	10 minutes	Smear count time:	1 minute
α/β/γ BKG:	50 cpm	Probe size:	20.27 cm^2
Efficiency:	15%	MDA:	487.8 dpm/100 cm^2

Note: Alpha efficiency used since < beta efficiency. Nearly all gamma emitters include a beta constituent as well. Nuclides limited to 100 dpm/100 cm^2 are not present in significant quantities. Based on recent waste analysis, I-129: 0.2%, Th-228: 0.02%, and Th-230 0.03%, isotopic to total activity.

If you have any questions regarding the submitted information, please contact me at extension 24.

Sincerely,

Glenn Roberts
INS Corporation
Health Physicist

cc: Mike Fuller, Manager, HP&E

Enclosures: As stated.

APPENDIX B
MDA Derivation

There are many different MDA calculations utilized in radiation survey and measurement. The following presents the derivation of INS' MDA calculation. As a basis, INS presents the following statistically rigorous generalized formula incorporating both Type I and Type II errors[1].

$$r_2 = \frac{k_\alpha}{2}\left\{\frac{k_\alpha}{t_g} + \sqrt{\frac{k_\alpha^2}{t_g^2} + 4r_b\left(\frac{t_g + t_b}{t_g t_b}\right)}\right\} + k_\beta\left\{\frac{k_\alpha}{2t_g}\left(\frac{k_\alpha}{t_g} + \sqrt{\frac{k_\alpha^2}{t_g^2} + 4r_b\left(\frac{t_g + t_b}{t_g t_b}\right)}\right) + r_b\left(\frac{t_g + t_b}{t_g t_b}\right)\right\}^{1/2}$$

where,
- r_2 = Minimum net observable count rate, MDC_N
- k_α = One-tail coefficient for Normal Distribution, Type I error
- k_β = One-tail coefficient for Normal Distribution, Type II error
- r_b = Background count rate
- t_b = Background count time
- t_g = Gross sample count time

A Type I error is a false positive, wrongly concluding that activity is present when actually there is none. A Type II error is a false negative, wrongly concluding that there is no activity present when actually there is activity. k_α and k_β are assigned based on the following table and the desired confidence level.

Normal Distribution, One-tailed Areas

Area, α	k_α	Confidence	Area, α	k_α	Confidence
0.5000	0.000	50.00%	0.0228	2.000	97.72%
0.2500	0.675	75.00%	0.0100	2.326	99.00%
0.1587	1.0000	84.13%	0.0050	2.576	99.50%
0.1000	1.282	90.00%	0.0013	3.000	99.87%
0.0500	1.645	95.00%	0.0002	3.5000	99.98%
0.0250	1.960	97.50%			

INS is not concerned with false positive results, and therefore only desires a 50% confidence level in avoiding false positives. INS is greatly concerned with false negative results, and therefore desires nearly a 98% confidence level in avoiding false negatives. Accordingly, k_α and k_β are assigned values of 0.0 (50% confidence in avoiding a Type I error) and 2.0 (97.72% confidence in avoiding a Type II error), respectively. With these substitutions, the above equation simplifies to the following.

$$r_2 = k_\beta\sqrt{r_b\left(\frac{t_g + t_b}{t_g t_b}\right)} = 2\sqrt{\frac{r_b}{t_g} + \frac{r_b}{t_b}}$$

Relationship between the Minimum D[illegible]ctable Activity (MDA) and r_2, or MDC_N, is given simply by the following equation.

$$MDA = r_2 / \epsilon$$

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[1]Turner, James, E., Ph.D., CHP, *Atoms, Radiation, and Radiation Protection*, 2nd ed., p 319