neutron products inc

*22301 Mt. Ephraim Road, P.O. Box 68*
*Dickerson, Maryland 20842 USA*
*301/349-5001 TWX: 710-828-0542*

July 6, 1989

Maryland Department of the Environment
2500 Broening Highway
Baltimore MD 21224

RECEIVED

JUL 7 1989

CENTER FOR
RADIOLOGICAL HEALTH

Attn: Mr. Roland Fletcher, Administrator
Center for Radiological Health

Dear Mr. Fletcher:

This letter, plus the report of the Health Physics Consultant ("HPC") for June, contains the item by item response required by your letter of June 22, 1989. The letter was received and logged on June 26, and accordingly this response is timely. The courtesy of the FAX transmittal was helpful and is appreciated.

Item 1 - The 100 $cm^2$ gas proportional detector was received on June 21 and is operational. Meanwhile, the HECM has been functioning well in its permanent location, and is providing the assurance against the inadvertant release of multi-nanocurie levels that was intended. No Limited Access Area operations have had to be suspended or abridged because of portal monitor failure.

Item 2 - With a few exceptions, the deficiencies alleged in item 2 of the MDE letter are cured or explained in the HPC report for June. However, the deficiencies alleged under C.1(c) and C.1(i) apply to company policies and the scope of Condition 33, not to the first HPC report. Our response to those allegations is set forth below.

2.1 The "requirement" that the HPC sign off on each procedure and all training documents was not part of Condition 33 C, and the lack of such signoffs does not constitute a deficiency in the required submittals. Nevertheless, I believe that we can accomodate the spirit, if not the letter, of the review you seek.

In accordance with our proposal of long standing, either the Radiation Safety Committee, the Internal Review Committee, or any employee can initiate a new procedure or a change in procedure. In this regard, we respectfully request that CRH recognize the role of the Internal Review Committee that was orally agreed to and reduced to writing several years ago, and that it withdraw its objections to my active participation.

The Radiation Safety Committee must approve all new procedures or changes in procedure, some of which must also be approved by the Internal Review Committee. The Chairman of either committee or Neutron's president may ask the HPC to become involved in the review of specific procedures. In those instances where the HPC participates or comments, his adverse comments or approval will be noted and will be available to the Department.

A|27

Moreover, we will send the HPC copies of all procedures so that he can maintain a current file, and in the course of other duties, he will review the effectiveness of most of our procedures. However, by any other means, his review of all procedures would trivialize his role, encroach on our other uses of his time, and compromise timely review and approval.

The HPC is a participant in the development, implementation and evaluation of a revised training program, and his comments on the adequacy of the proposed program are appended thereto.

We believe that the foregoing should satisfy the Department's requirements for internal review. If not, please explain.

2.2 Our comments with regard to CRH rejection of the proposed release levels are set forth under Item 3.

2.3 For the reasons set forth below, we respectfully request the Department to reconsider its position on local skin exposure limits.

At this stage of the ongoing hot particle debate, it is unreasonable to apply, to the exposure of 1 square centimeter, a regulation designed to limit exposure of the skin of the whole body. The fact is that there is no regulation directed to local skin exposures.

In order to have a competent interim guideline, we have proposed to adopt the NCRP's extremely conservative recommendation of 75 microcurie-hours. We furnished CRH a copy of the NCRP report, which you presumably reviewed. If you take exception to it on the merits, please explain.

In May, The Advisory Committee on Reactor Safeguards reviewed the issue, and objected to the interim use of 50 $R/cm^2$ (vis-a-vis the limit of 7.5 demanded by CRH) as being too low. A copy of the ACRS letter to Chairman Zech on that matter is enclosed for your edification and convenience.

To the best of our knowledge, which is much more subtstantial than it was on March 8, a 75 microcurie-hour skin exposure to a cobalt-60 particle constitutes a substantially risk free event. Why add an additional safety factor of 40?

In the meeting between MDE, Neutron and NRC on March 8, we were surprised by the alleged severity of a risk of long standing that we had not previously recognized as serious, and we asked for evidence that the so-called "hot particle" phenomenon was of physiological substance. The details were to be furnished by NRC on March 13, but were not forthcoming, then or since; and to the best of our knowledge and belief, there is no such evidence.

To the extent that low activity cobalt-60 particles on the skin constitute a hazard that we can understand, we can provide appropriate protection; and as you know, Neutron management constitutes a portion of the workforce at risk in the conduct of operations during which the risk is greatest. However, the risk articulated to date has been so devoid of substance that the 75 microcurie-hr limit proposed by NCRP appears to be amply conservative.

If CRH has any evidence of physiological risk or duly considered regulatory requirement, please furnish same so that we can reach agreement on protective practices that are credible to those who are to be served thereby. Meanwhile, we and our fellow Marylanders ski, play tennis and golf, garden and farm, sail, water ski, canoe, swim, suntan, fish, and engage in construction and other outdoor activities that subject us to a high probability of skin cancer. Do you really want to prevent a few of us from accepting risks that are trivial by comparison (see the NCRP report) in order to accomodate the treatment of some of the uncontrolled melanomas that will inevitably result from the ordinary activities of ourselves, our families, friends and fellow citizens?

Item 3 – I'm not sure I understand the issue, but our position is as follows:

3.1 If you wish, we will amend NPI procedures R-1011 and R 1003 to conform them to Table 1 of NRC Reg Guide 1.86; but doing so will reduce our margin against a regulatory infraction. Neither of these procedures changes the duly prescribed regulatory requirement, and both would provide margin against infractions if CRH would allow them to function as intended.

When we established a procedural standard of 440 dpm/100 $cm^2$ for the control of smearable removable contamination, that didn't change the Reg Guide limit of 1,000 dpm/100 $cm^2$; and if we try to limit the uncontrolled release of fixed contamination to 10,000 dpm per 100 $cm^2$, that shouldn't change the Reg Guide limit of 15,000.

The lower limits called out in these procedures are designed to provide protection against a regulatory infraction; but that purpose is defeated if CRH insists on regulating to our procedures instead of its regulations.

3.2 If, upon further reflection, CRH remains unwilling to allow us to provide margin against regulatory infractions, we will change the limits for uncontrolled release to the Reg Guide limits of 1,000 dpm/100 $cm^2$ for smearable removable, and 15,000 dpm/100 $cm^2$ for fixed contamination. In any event, we are prepared to apply ALARA to controlled releases above these levels, using a value of $1,000 per man-Rem of off-site exposure.

Please advise, and we will amend R-1011 and R 1003 accordingly.

<u>The Status of Submittals</u>

Of the six submittals listed in your letter, three (those required for a Floor Monitoring Plan (Condition O), a Waste Disposal Plan (Condition K), and a Plan for Random Inspections (Condition I), were submitted with my letter of June 21.

Two others - the Radiation Safety Training Program (Condition H), the Environmental Surveillance Program (Condition D.8 and N)- are enclosed herewith, and the Courtyard Enclosure Plan (Condition M) will follow shortly.

I trust that this letter, the enclosed reports, and the HPC report for June will enable CRH to support the Department's grant of the expansion of P.2 Scope requested in ours of June 21 without further delay, and the start of P.3 by July 17 as requested in the enclosed letter of even date to Mr. Ward. If substantive issues interfere with the grant of these requests, I have suggested to Mr. Ward that they be resolved on July 10 in the course of a May 1 type meeting.

Very truly yours,

NEUTRON PRODUCTS, INC.

J. A. Ransohoff, President

cc: Lawrence M. Ward

neutron products inc

*22301 Mt. Ephraim Road, P.O. Box 68*
*Dickerson, Maryland 20842 USA*
*301/349-5001 TWX: 710-828-0542*

July 6, 1989



Maryland Department of the Environment
2500 Broening Highway
Baltimore MD 21224

Attn: Mr. Roland Fletcher, Administrator
Center for Radiological Health

Dear Mr. Fletcher:

This letter, plus the report of the Health Physics Consultant ("HPC") for June, contains the item by item response required by your letter of June 22, 1989. The letter was received and logged on June 26, and accordingly this response is timely. The courtesy of the FAX transmittal was helpful and is appreciated.

Item 1 - The 100 $cm^2$ gas proportional detector was received on June 21 and is operational. Meanwhile, the HECM has been functioning well in its permanent location, and is providing the assurance against the inadvertant release of multi-nanocurie levels that was intended. No Limited Access Area operations have had to be suspended or abridged because of portal monitor failure.

Item 2 - With a few exceptions, the deficiencies alleged in item 2 of the MDE letter are cured or explained in the HPC report for June. However, the deficiencies alleged under C.1(c) and C.1(i) apply to company policies and the scope of Condition 33, not to the first HPC report. Our response to those allegations is set forth below.

2.1 The "requirement" that the HPC sign off on each procedure and all training documents was not part of Condition 33 C, and the lack of such signoffs does not constitute a deficiency in the required submittals. Nevertheless, I believe that we can accomodate the spirit, if not the letter, of the review you seek.

> In accordance with our proposal of long standing, either the Radiation Safety Committee, the Internal Review Committee, or any employee can initiate a new procedure or a change in procedure. In this regard, we respectfully request that CRH recognize the role of the Internal Review Committee that was orally agreed to and reduced to writing several years ago, and that it withdraw its objections to my active participation.
>
> The Radiation Safety Committee must approve all new procedures or changes in procedure, some of which must also be approved by the Internal Review Committee. The Chairman of either committee or Neutron's president may ask the HPC to become involved in the review of specific procedures. In those instances where the HPC participates or comments, his adverse comments or approval will be noted and will be available to the Department.

# Morton and Potter

10421 MASTERS TERRACE
POTOMAC, MARYLAND 20854

HENRY W. MORTON
10421 MASTERS TERRACE
POTOMAC, MARYLAND 20854
301-983-0365

THOMAS E. POTTER
4231 JENIFER STREET, N.W.
WASHINGTON, D.C. 20015
202-363-4727

7/6/89

Mr. Jackson Ransohoff
Neutron Products, Inc.
Dickerson, MD 20842

Dear Mr. Ransohoff:

Enclosed is the second monthly report describing my evaluation of the NPI radiation protection program. This report is intended to respond to condition 13.C.1 to 13.C.6 of your license issued by the State of Maryland. Please call if you have any questions.

Sincerely,

Thomas E. Potter

Thomas E. Potter



TECHNICAL CONSULTANTS

RADIATION PROTECTION EVALUATION
OF NEUTRON PRODUCTS, INC.

MONTHLY REPORT 2

7/6/89

by

Thomas E. Potter

Thomas E. Potter

Morton and Potter
10421 Masters Terrace
Potomac, MD 20854

301-983-0365

# RADIATION PROTECTION EVALUATION OF NEUTRON PRODUCTS, INC.

## MONTHLY REPORT 2

### Introduction

This evaluation was undertaken in response to conditions added to Condition 13 of MDCRH license 31-025-01 added by Amendment 33. Section numbers and titles in this report are keyed to the above noted conditions. This report is the second of 6 monthly reports required by the amendment. The first report was dated 5/22/89.

In keeping with the approach of the first report, the work plan for this evaluation period has been tailored to the present situation, operation with doubly-encapsulated sources only, and the proposed plan for the next phase of operations, operation with singly-encapsulated cobalt and unencapsulated cobalt (excluding melting).

The last month, an eventful one, has included:

- extensive decontamination in the contamination control zone, and marked reduction of contamination levels in the hot cell and pool area of the LAA.
- upgrading the contamination control aspects of a number of procedures,
- completion of the new clean room and clothing change facility,
- installation of the Personnel Contamination Monitor in its permanent location,
- installation of a new effluent sampler on the hot cell ventilation system exhaust,
- completion of a waste management plan,
- and shipment of 7 sources.

This work was performed without serious incidents involving radiation. A fire, discussed below, occurred in an electrical breaker box and resulted in burns to the electrician working on the box, but there were no serious radiation consequences and no significant damage to the facility equipment, other than the breaker box. Several persons experienced cobalt-60 contamination events that are reportable herein and are instructive, but they were isolated and minor in consequence. The evaluation of these occurrences to determine significance and appropriate response is discussed below. From my review of overall performance and consideration of the implications of the events that did occur, I conclude that NPI can satisfy the recently revised regulatory criteria in conducting operations with singly-encapsulated cobalt and, subject to conditions noted elsewhere herein, can also conduct operations with unencapsulated cobalt.

C.1.a Contamination Control Procedures and Methods

Introduction and Summary

Contamination levels throughout most of the hot cell and pool work area are low and contamination control in these areas is generally adequate. Extensive decontamination of the floors, walls, and other surfaces in some of the rooms in the contamination control zone during the period 5/24 through 5/31 greatly reduced contamination levels in the last reporting period.

Operations with doubly-encapsulated cobalt did not increase contamination levels. In fact, due to continuing decontamination efforts, contamination levels declined during those operations. Contamination from the hot cell interior surfaces was controlled effectively during operations with doubly-encapsulated cobalt. Contamination limits on sources and source containers were readily met.

No access to the hot equipment room was required for operations involving doubly-encapsulated cobalt. Equipment from the hot equipment room may be needed for operations involving singly-encapsulated or bare cobalt. I recommend that a radiation work permit be prepared for access to the hot equipment room. Requirements should be based on appropriate consideration of the potential for internal and external exposure and the potential for contamination spread during handling.

Potential Sources of Contamination

No new sources of contamination were identified in the last reporting period.

Pool water was identified as a potential significant source of contamination in the last report. The concentration of cobalt-60 in pool water presently approaches 0.001 microcurie per cubic centimeter. I had thought that critical evaluation of handling techniques involving removal of sources and equipment (tools, filters, resin cartridges, etc.) from water pools could be performed during activities authorized by P.2 and completed before initiating activities authorized by P.3. However, the activities involving doubly-encapsulated sources conducted under present license condition P.2 required only limited pool operations confined to the south canal, which is substantially lower in cobalt-60 concentration than the main pool. Therefore, there was no opportunity to evaluate the significance of those operations as a source of contamination on the floors and other surfaces of the building. This evaluation should be rescheduled for P.3 operations or for other operations, such as filter and resin changes. Routine smears since June 8 in the vicinity of the pool have not exceeded 10,000 dpm per 100 square centimeters, and have been typically below 3,000.

The procedure for the contamination control zone was upgraded to provide a clearer delineation of the line of demarcation, with appropriate step-off areas. Procedures have been upgraded to require more clearly that tools and equipment meet clean side decontamination limits before they can be moved out of the contamination control zone.

Status of LAA Areas Outside the Contamination Control Zone

Data show that contamination is currently well-controlled in these areas. Floor smear surveys of the operating area surrounding the hot cell indicate that contamination levels are consistently low. Data are summarized in Table 1, which summarizes results of smears from June 8 through June 27. Operations with doubly-encapsulated cobalt started June 7. Most smears were below the limit, approximately 1,000 dpm per 100 square centimeters. The highest smear was 11,000 dpm per 100 square centimeters. Overall, 172 of 225 smears were below 1,000 dpm per 100 square centimeters. Only 12 exceeded 3,000 dpm per 100 square centimeters, and none exceeded 11,000. (Areas with contamination levels exceeding the limit were decontaminated and resurveyed to assure limits were ultimately met.)

Contamination levels declined through the period. In the period from June 19 through June 27, 105 of 118 (89%) smears from this area were below 1,000 dpm per 100 square centimeters. This is a marked improvement over the period from June 8 through June 15, in which 67 of 107 (63%) were below 1,000 dpm per 100 square centimeters. As contamination control practices continue to improve, the frequency of exceeding the limit should remain low. However, the frequency should not be expected to fall to zero, because of releases due to human error, transport from contamination zones by means not anticipated, and releases of currently fixed contamination (such as material in floor paint), and occasional releases of residual removable contamination in locations that cannot be readily decontaminated, can be expected to occur from time to time in the future. The monitoring program now in place provides a high level of assurance that such occurrences will be detected and that radiological consequences will be acceptable.

Status of the Contamination Control Zone

Smearable contamination levels on the floors and other surfaces in the contamination control zone were reduced greatly during the decontamination at the end of May. They have been reduced further during the last reporting period. Additional decontamination is required for some surfaces above the floor, but floor smears are currently typically below 10,000 dpm per 100 square centimeters. Floor smear data are summarized in Table 2, which includes results of smears from June 8 through June 27. (These data do not include smears from the the floor along the west side of the pool, which are consistently lower than data for other parts of the contamination control zone.) During the first several days of the operating period, which began on June 7, daily contamination levels ranged from 5,000 to 256,000 dpm per 100 square centimeters, and the daily median value ranged from 9,000 to 50,000 dpm per 100 square centimeters. During the last several days of the period, daily contamination levels ranged from 1,000 to 20,000 dpm per 100 square centimeters, and the daily median value ranged from 1,000 to 7,000 dpm per 100 square centimeters. The floor in the contamination control zone is currently being mopped at least once daily.

Based on experience of the last month, contamination control measures in the contamination control zone are effective. A new limit for contamination levels in the contamination control zone is desirable. This limit would apply at all times except during major cell cleanups when special control measures are in effect. Decision should be postponed until further attempts to reduce levels of surface contamination approach the point of diminishing returns. It may be appropriate to have different levels for different parts of the zone.

Work Area Decontamination

Routine work area decontamination procedures have not changed in the last reporting period, but the frequency of floor mopping in the contamination control zone has been increased as noted above. A special decontamination of surfaces in the contamination control zone was performed with paper towels and liquid cleaner.

Control of Contamination Transport to the Courtyard

The limited access area extends out into the yard from the hot cell area. Removable contamination levels in the yard typically remain lower than 1,000 dpm per 100 square centimeters. In my last report I stated that it is not likely that tracking of contamination on shoe covers is a significant mechanism for continuous contamination transport to the yard through these doors. Data collected during the last period strongly supports that position.

I previously recommended establishing a frisking station at the personnel access door to the courtyard as a precaution against transporting substantial levels of contamination to the courtyard in the event of an undetected release, which, I concede, would be an unlikely event. Noting that background levels are too high to permit very sensitive frisking, NPI instead elected to establish a procedure requiring the use of clean shoe covers in the courtyard and instituted the procedure in the last reporting period, and I concurred. Prior to that there was no monitoring or shoe cover change at the entrances to the yard on the basis that there was no apparent need.

I have observed operations in the courtyard with shoe covers, and have concluded that shoe covers tear or get wet too frequently to be effective as a contamination control measure in this application. I recommend abandonment of the shoe cover procedure and reconsideration of the frisking station. I believe a pancake G-M frisker would be sensitive to less than 2,000 cpm (or less than 13,000 dpm per 15 square centimeters) even in a field of about 1 mR/hr, the current background at the door. A shielded detector could increase the sensitivity by a factor of 2 to 4. These levels are sufficient to accomplish the rough screening that I believe is desirable.

Large-area doors to the building are required to move equipment in and out. The procedure for using large area doors has been modified so that these doors are opened only when necessary. Contamination levels in the machine shop and in the area near the north canal continue to be low, so the potential for spread of substantial contamination to the courtyard through those paths is small.

Contamination levels on the doors from the courtyard to the hot cell access room and the decon room have been reduced, but the doors have not been used in P.2 operations. Contamination levels in the hot cell access room and the adjacent decon room have been greatly reduced in the last reporting period. Floor contamination levels remain a factor of 2 to 10 higher than in other areas. When contamination levels on other surfaces are reduced to levels comparable to floor levels, contamination levels will be sufficiently low to assure that material and equipment can be moved through the doors without significant transport of contamination to the courtyard. The procedure for the contamination control zone and the improved definition of the zone boundaries make it clear that doors to the courtyard are boundaries to the contamination control zone. Thus, procedures for exiting the contamination control zone and for removing equipment and material from the zone apply to materials moved to the courtyard from the hot cell access room and the decon room. The standard practice for monitoring prior to opening the doors should apply.

Dry shipment of radiation processing sources may require cask transfers to and from the hot cell in such a way that both the cell door and the large door to the courtyard behind the hot cell are open at the same time. Experience with P.2 operations has shown that air concentrations in the cell and in the room behind the cell are routinely very low whether the cell door is open or closed. The potential for contamination release during cask transfers with both doors open would be comparable to existing conditions, so this procedure should be workable.

Status of Areas Outside the LAA

Floor smears outside the LAA are consistently less than the lower limit of detection. However, the lower limit of detection, about 1,000 dpm per sample (3 times sigma net for a sample count time of 1 minute) is about a factor of 2 higher than the procedural limit of 440 dpm for a smear of 100 square centimeters. A background count rate reduction of 30 percent or more would be required to reduce the lower limit of detection to the license limit. The practicality of increasing the detector shielding will be evaluated in the next reporting period. In the interim, the areas of smears collected outside the LAA will be increased to 300 square centimeters to assure that the lower limit of detection is less than the procedural limit.

Work Area Air Sampling

High-volume grab samples were collected approximately four times per day in the last reporting period. Measured air concentrations were less than 5 percent of the restricted area maximum permissible concentration of 9 x 10-9 microCuries per cubic centimeter, except during decontamination activities in the contamination control zone, during which concentrations approached about 30 percent of the maximum permissible



JEF 7/6/89

concentration. (Workers wore full-face respirators during the decontamination as a precautionary measure.) In all other cases, concentrations were below 5 x $10^{-10}$ microCuries per cubic centimeter, a factor of about 20 below the maximum permissible concentration for restricted areas and only about a factor of 2 greater than the maximum permissible concentration for unrestricted areas. These samples include 7 samples from inside the hot cell. I recommend frequent monitoring of hot cell air during operations with singly-encapsulated cobalt and evaluation of data collected prior to operation with bare cobalt.

Whole body counting should continue to be the primary measurement of worker internal radiation exposure, but air sampling should be continued to aid in the identification and evaluation of the significance of potential contamination sources. I recommend continuing the increased frequency of air sampling. High-volume air samples should be collected approximately every two hours in the LAA areas where work is being done. I would prefer to see about half of the samples collected in the hot cell and the hot cell access room while work is going on in those areas, even if scheduling this causes the time interval between samples to slip an hour or two.

Work Area Contamination Surveys

Work area smear surveys continue to be taken daily inside the LAA and monthly outside the LAA. Clean area floors within the LAA are smeared daily in a representative way. I recommend that this portion of the survey be expanded to include about 6 daily smears from the clean room (including 2 from surfaces above the floor) Results from these smears can be used to provide early detection of transport of contamination to the building outside the LAA.

The number of smears in the daily surveys in the contamination control zone has been increased, but I recommend a further increase to a level 15 to 20 smears per day (including smears from surfaces and equipment above the floor) to make the surveys more representative.

The number of smears taken from surfaces above the floor in the LAA has been increased. These are usually collected as separate surveys, which are not performed daily. I recommend incorporation of these smears into the daily routine and showing them on the same form. A code or abbreviation next to the smear number on the form should be adequate to indicate the nature of the item smeared. I recommend that in deciding on items to be smeared, technicians pay particular attention to items that are potentially contaminated.

C.1.b Respiratory Protection Program

No changes to the respiratory protection program were made during the last reporting period.

Respiratory protection equipment was used on 9 occurrences (one man for one work session) in the decontamination of the Controlled Contamination Zone and during 1 occurrence in the hot cell wipedown. Respiratory protection measures were properly used and were clearly effective in the Controlled Contamination Zone decontamination. Calculated air concentrations based on activity on filter cartridges were typically 0.2 to 1.0 times the restricted area MPC, but were 4 and 10 times the restricted area MPC in two occurrences. In all cases nasal smear activities were near or below minimum detectable levels, about 1,000 dpm.

A procedural lapse complicated the evaluation of respiratory effectiveness in the case of the hot cell wipedown. This case is discussed in Section C.1.j.

C.1.c Personnel Monitoring for Internal and External Radiation Exposure

Worker external radiation dosimetry

No changes in dosimetry have been made in the last reporting period.

Worker internal radiation measurements

No new whole body counting results were obtained this period. Routine body counting is scheduled for mid-July, 1989.

Although the personnel contamination monitor is designed and intended for detection of external contamination, it demonstrated unexpectedly high efficiency for detection of gamma radiation from internal contamination. Preliminary calculations show that levels substantially less than a lung burden (present as uniformly distributed source in a 20-cm cube of tissue, an approximation to the lung) and far less than a maximum permissible body burden should be routinely detectable. This capability makes the instrument useful as a screening device for ingestion or inhalation exposures. Source and detector geometry considerations and variation in response with gamma energy complicate the precise determination of efficiency and lower limit of detection, but this question will be pursued in the next period to assure maximum benefit is gained from data provided by the instrument.

C.1.d Radiological Effluent Monitoring and Control for Liquid and Gaseous Releases

Monitoring and Control of Gaseous Effluent

Evaluations of control measures for gaseous effluents and procedures for effluent air monitoring are discussed in a separate report, dated 5/17/89, on the hot cell ventilation system. The new monitoring system was used for the entire reporting period. Samples were collected approximately weekly and no sample activity exceeded detection limits ($7 \times 10^{-13}$ microCuries per cubic centimeter for a 7-day sample, 3 sigma for the net count). This is equivalent to about 0.2 percent of the unrestricted area MPC of $3 \times 10^{-10}$ microCuries per cubic centimeter). Results for parallel samples collected by the previously used sampling method were consistent. Responses to CRH requests for additional information related to the effluent air sampling system are included in Addendum 1.

Monitoring and Control of Liquid Effluent to WSSC

Evaluation of liquid effluent sampling and control indicates that releases to the Washington Sanitary Sewer Commission are low and controls are adequate. Isotope quantities released in the last period are small, approximately 2.1 milliCuries in May and 3.2 milliCuries in June (through June 27). During this period 57,000 gallons were shipped. The average concentration was approximately $2.4 \times 10^{-5}$ microCuries per cubic centimeter, far lower than the 10 CFR Part 20 Appendix B Table 1 limit of $1 \times 10^{-3}$ microCuries per cubic centimeter, and substantially below the more conservative license limit of $2 \times 10^{-4}$ microCuries per cubic centimeter.

Operations involving singly-encapsulated or bare cobalt-60 will not result in significant increases in levels of cobalt-60 in liquid effluents.

Monitoring and Control of Waterborne Releases through the Drypond

Cobalt-60 released from the facility buildings is apparently washed by rain to the drypond and to areas beyond the drypond. Actions required here are evaluation and control of releases of cobalt-60 from the facility, assessment of current release rates from the courtyard to the drypond and offsite areas, and evaluation of the significance of past releases to the drypond and offsite areas.

The activities of the first reporting period were focused on assuring that cobalt-60 releases from facility buildings are small and are controlled so that they will continue to be small in the future. It is now clear that releases from the hot cell ventilation system are not presently contributing to cobalt-60 deposition in the environment, and it is highly likely that contributions in the past have been negligible. The transfer of contamination to the courtyard by tracking or by transport on contaminated materials and equipment is not precisely measurable, but is almost certainly small due to tighter controls on surface contamination in the plant and better monitoring of contamination levels on material and equipment removed from the plant instituted in the first reporting period.

Existing data were collected and evaluated to determine whether it constitutes an adequate basis for estimation of inventory and release rates from this pathway. Available data include spot checks of water and soil concentrations and extensive measurements of direct radiation.

Spot checks of water concentrations show that concentrations of cobalt-60 in runoff to the drypond are below detection limits (about $3 \times 10^{-6}$ microCuries per cubic centimeter (3 times sigma for the net count). Therefore, concentrations in these samples have not approached the maximum permissible for release to unrestricted areas ($5 \times 10^{-5}$ microCuries per cubic centimeter for soluble cobalt-60 and $3 \times 10^{-5}$ microCuries per cubic centimeter for insoluble cobalt-60), but the number of samples is too small to constitute reliable evidence of low releases over long periods of time. To be representative, water samples would have to be collected during flow at sampling rate proportional to water flow rate.

Soil samples are a measure of integrated releases. But only a few soil samples have been collected and analyzed. They are too few to characterize the area and too few to assess the trend in concentration with increasing distance from the discharge from the drypond. Some of these samples were collected at different depths and these measurements show that activity is confined largely to the top inch of soil. It is not known whether this small number of samples is representative of all contaminated soils in this respect.

Direct radiation levels fall off substantially with distance from the drypond discharge. Most of the released material is located in the area of the drypond discharge. Available direct radiation measurements in this area are sufficient to make a rough estimate of on the inventory of activity present in the drainage area and drainage paths outside the drypond. NPI measurements from March, 1989, spot checked by my field measurements in this period, average about 75 microroentgen per hour at a height of 5 centimeters over an area of about 600 square meters outside the drypond. Levels at a height of 1 meter are somewhat lower. This level would be equivalent to an inventory of roughly 1 milliCurie.

The estimate of the inventory constitutes an imperfect but achievable estimate of the integrated release and the concentration of cobalt-60 in runoff water from the plant. The average concentration in runoff water, based on an assumption of a drainage area of 1 acre, and a rainfall of 80 inches over the first two-year drypond operating period is approximately $1 \times 10^{-7}$ microCuries per cubic centimeter, a factor of 300 less than the maximum permissible concentration for water released to unrestricted areas, $3 \times 10^{-5}$ microCuries per cubic centimeter.

One uncertainty associated with this estimate is that concentration may not fall off markedly with distance, but dose rates fall off because of the way the geometry of the source changes from an area source to a line source as one moves away from the pond discharge toward the channel that carries effluent along the railroad tracks adjacent to the site. Scouring of sediment may also remove deposited cobalt-60. A third uncertainty derives from the inability to quantify the fraction of cobalt released through the drypond that is not subject to sorption on soil. Existing data provide inadequate evidence to show that these transport mechanisms are important. In any event, it is likely that quantities and concentrations of cobalt-60 leaving the area in these ways have been very low to start, and it is certain that they have been further reduced downstream by dilution. Therefore, these releases have probably been inconsequential.

I recommend the following:

- Make the drypond and the area adjacent that contains most of the cobalt-60 a temporary restricted area, posted and provided with access control in accordance with regulatory requirements. Exposure of members of the public to doses exceeding limits is not likely in the current unrestricted condition, based on radiation and contamination levels present, but the added control seems prudent.

- Plan and conduct systematic soil sampling and analysis in the drypond area, the adjacent area outside of the drypond, the drainage ditch along the rail tracks, the drainage pipe at break locations, and the drainage creek below the railroad bridge. The objective should be to determine the trend in concentration with distance from the source. The planning will be necessary to develop proper techniques for sampling and preparation of samples (drying, weighing, etc.,) for counting.

- Investigate the feasibility of an automated water sampling system that would sample effluent from the plant at a rate proportional to flow. The sampling point should be at or downstream of the drain that collects runoff from the shipping dock beneath the cafeteria.

C.1.e Adequacy of Air Handling Systems in the Production Areas

There have been no changes to the air handling system since the last report. Concentrations of cobalt-60 in air in operating areas have been far below permissible limits throughout the last reporting period (see C.1.a).

C.1.f Control and Identification of Radiation and High Radiation Areas, and Contaminated Equipment and Facilities

High Radiation Areas, Major Gamma Radiation Sources and Control Measures

Major radiation sources, control measures, and levels have not changed significantly in the last reporting period. The decon room has been posted as a high radiation area because radiation levels in the decon room near the door to the hot equipment storage room (previously established as a high radiation area provided with posting and access control) exceed 100 mR/hr. Other control measures for the decon room are being evaluated.

Work area direct radiation surveys

Routine radiation surveys continue to be performed as described in the last report.

Control and identification of contaminated equipment and facilities

These topics are discussed in Section C.1.a.

C.1.g Radiological Waste Handling, Processing, and Disposition (Storage and Shipment)

Inspection of the waste storage rooms indicates that the storage capacity for additional radioactive waste remains limited. This is not a problem for operation with encapsulated cobalt because the quantities of waste generated are expected to be small and the isotope inventories low. I reviewed draft and final forms of the plan for disposal of radioactive waste submitted to CRH and agree that it is reasonable. I also reviewed F. Schwoerer's memo dated June 6 to the Internal Review Committee regarding plans for waste compaction.

C.1.h Hot Cell Decontamination Methods and Procedures

A hot cell wipedown was conducted on June 7, prior to operation with doubly-encapsulated sources. Exposure rates prior to wipedown ranged generally from 250 to 800 mr/hr and ranged generally from 250 to 600 mr/hr. Exposure rates after the wipedown were approximately 250 mr/hr at the center of the cell five feet from the floor. Exposure rates over a tank in the cell were about 1,200 mr/hr, but were reduced to 1,000 mr/hr after the wipedown and were reduced further to 700 mr/hr after addition of water to the normal level. Smears from the hot cell front wall, side wall, and work table surface were 2.1, 0.16, and 0.6 microCuries per 100 square centimeters prior to the wipedown and 0.08, 0.07, and 0.6 microCuries per 100 square centimeters after the wipedown. Smears of the work table surface on June 21 were 1.0 and 0.42 microCuries per 100 square centimeters.

Operation with doubly-encapsulated cobalt-60 has not added significantly to contamination levels inside or outside the cell. No significant transport of contamination from inside the cell to outside work areas has been evident. This experience is a sound basis for expecting that operation with singly-encapsulated cobalt will also be successful. I recommend frequent smears of interior surfaces of the hot cell during activities with singly-encapsulated cobalt to assist in evaluation of readiness for operation with bare cobalt.

C.1.i Personnel Training and Qualification

The generally successful conduct of a wide range of activities in the last reporting period speaks well of the qualifications of the staff.

In the last report I recommended that the capabilities of key personnel, including professional personnel, should be developed further in the following areas:

- interpretation and analysis of radiation protection measurement information,

- critical evaluation of radiation protection aspects of operating procedures and radiation protection procedures, and

- selection, calibration, and use of radiation monitoring instrumentation.

These recommended improvements were intended to be on-going activities, and were not intended to be fully implemented in the first reporting period. However, significant improvements were made in the first two areas, and some improvement was made in the third area during the last reporting period. In particular, the evaluation of personnel contamination incidents was much improved. Evaluation of routine monitoring data by the RSO was also improved.

Two isolated events during the last reporting period show that additional improvements in the first two areas are desirable. In particular, evaluations of internal personnel contamination should be designed to determine by measurement whether the exposure pathway was ingestion or inhalation. The events are discussed in Section C.1.j and C.4.

There were occasional lapses in procedures during the last reporting period. They were minor in nature, but they show that periodic review of procedures and standing radiation work permits is a necessary part of the training program. I recommend that it be instituted immediately and that it begin with procedures for which contamination control elements are particularly important, such as hot cell operations, pool resin change, etc. Infrequently used procedures and permits should routinely be reviewed by the operator before starting the operation. I also recommend that lists be kept showing which operators are qualified for which procedures and permits and the date on which qualification expires. I recommend that annual review of the procedures and permits be a minimum requirement for requalification. The process for review of the procedure should provide for an assessment by management that the operator understands the key features of the procedure and interprets the procedure properly.

I believe that implementation of the recommendations above, together with continuation of improvement trend established in the last reporting period should be sufficent to develop and to carry out procedures appropriate for use with singly-encapsulated cobalt and the processing of bare cobalt components. The judgment of the adequacy of training should be based on performance in future operations.

## C.1.j Management Oversight and Control of Radiological Activities

Management personnel have been deeply involved in oversight and control of radiological activities in the last reporting period.

The last report included recommendations for improvements in management control. The recommendations were intended as standing guidance for ongoing improvement and were not intended to be fully implemented immediately. Improvements were made in this reporting period:

- Clear assignment of responsibilities

  Assignments of responsibilities, though informal, seem reasonably clear.

- Specification in key procedures of action levels and corresponding actions, including documentation, evaluation, and management notification, sufficient to bring events to closure

  This recommendation has been implemented in all new or modified procedures. Work remains to be done on old procedures.

- Management oversight of radiation protection procedures and operations and radiation protection aspects of production and maintenance procedures and operations

  Methods for interpretation of area contamination information were developed and implemented in the last period.

  Regular review of personnel contamination data by the RSO was instituted.

  Planning and oversight of the Controlled Contamination Area decontamination activity was thorough and effective. In particular, the judgment to require respiratory protection based on anticipated increases in air concentration rather than on air concentration measured prior to the start of operations is commendable and was correct.

  Planning and oversight of the cell wipedown was not sufficiently thorough, and resulted in the failure to collect air samples and in the contamination of some exposure assessment data that might have served to



JEP
7/6/89

substitute for the air sample data. The data that were collected were not evaluated. I recommend that procedures and RWPs be modified to require more clearly RSO evaluation and planning of operations that can be anticipated to present a potential for significant internal or external exposure. I also recommend that procedures and practices for assessing exposures and potential exposures during the use of respiratory protection equipment be strengthened further. The event is described in more detail below.

- Procedures for approval of changes to work methods and procedures, including radiation protection review of proposed changes where appropriate

  No formal action.

- Summarization and communication of radiation protection information

  Methods for the concise summarization of area contamination information were developed in the last period. These methods will be suitable for use in periodic reports to management.

The case of the hot cell wipedown is instructive regarding the importance of careful planning and oversight and the need for continuing improvement. The air concentration measured in the hot cell prior to the wipedown was 2.8 x 10-10 microCuries per cubic centimeter. The operator reviewed the RWP and wore the specified protective clothing. During the hot cell wipedown the operator wore a full-face respirator, but no air sample was collected during the operation. On exiting, the operator removed his own clothing. The filter cartridge was counted, and were found to contain 0.86 microCuries of cobalt-60, much higher than would be expected. Nasal smears were elevated (about 5,000 dpm total for three smears) indicating that some inhalation exposure occurred. No contamination was detected in the Personal Contamination Monitor.

There was no exposure assessment at the time. The results of the cartridge and nasal smear counts were not communicated to the RSO. The RSO did not inquire about the data until requested to do so by the consulting health physicist after a day or more had passed. There was no attempt to analyze the filter media from the inside of the cartridge or to decontaminate the outside of the cartridge to try to determine the source of the contamination. (Data from the Personal Contamination Monitor places an upper bound on any inhalation exposure at a level not precisely quantifiable, but well below regulatory limits.



7/6/89

However, the utility of the instrument for detecting internal contamination at that level was not known at the time.)

This experience does not evidence a failure of the respiratory protection function, but it is evidence of poor handling technique. This experience also constitutes failure to follow the exposure assessment requirements of the respiratory protection procedure, but the more important deficiency was in planning and overseeing the operation, without which the other failures would not have occurred.

C.2 Portal Monitor Installation and Maintenance

The personnel contamination monitor (PCM) was installed on June 15 in its permanent location in a concrete block cubicle in the clean room. The procedure for operation of the PCM has been working smoothly. Procedures for maintenance of the equipment are complete. The instrument has operated continuously (during working hours) and stably since installation. No maintenance, or repair has been required. No detector decontamination has been required.

C.3 Background at Portal Monitor

The background radiation level in the personnel contamination monitor area is approximately 40 microRoentgen per hour, as estimated from background on a pancake G-M counter. Although the exposure rate at the new location is slightly lower than at the previous location, backgrounds on the PCM detectors are slightly higher, ranging from 30 to 74 cps, compared to the previous range from about 30 to 50 cps. The reason for this response is not known. One possible explanation is a difference in the background gamma energy spectrum. The new location is heavily shielded, and it is possible that the photon energy is somewhat lower in the new location due to scattering in the shield material. The instrument may be more sensitive to lower energy photons.

The count time is presently about 34 seconds. The background count time is 120 seconds. At these levels lower limits of detection below 2,500 dpm on hands and 5,000 dpm on other unshielded surfaces reasonably close to the detector are achieved with a false alarm probability (Type I error) less than 8 percent, and a failure-to-detect probability (Type II error) of 0.8 percent, provided that self-shielding effects are not too severe (see C.4).



JP/109

C.4 Portal Monitor Performance Report

The personnel contamination monitor has performed well to date. Personnel assigned to operation of the PCM have received OJT instruction in the monitoring procedure, including reporting requirements, and the procedures appear to be effective. Personnel who work in the LAA have received OJT instruction in new LAA access and exit procedures. In this reporting period, five reportable (>22,000 dpm) personnel contamination events occurred. These are summarized below:

A. 5/31--33,000 dpm

The shirt of one of the 7 firemen responding to a fire in an LAA electrical breaker box became contaminated in one spot. It was readily removed. No other firemen were contaminated in excess of 10,000 dpm. No significant inhalation exposure occurred, based on air sample results. This incident has little implication for routine operations. The occurrence of only one minor contamination event in the difficult situation of firefighting in an area in which construction increased the potential for loose contamination is evidence that the response was well-managed.

B. 6/7--43,000 dpm

An inspector's clean shoe cover became contaminated in transit between the clean room (then only partially completed) and the temporary Personal Contamination Monitor location. This occurrence shows the need for frequent monitoring and cleaning of the clean room, particularly during construction activities in the transition room, which are the most probable source of contamination in the clean room.

C. 6/21--internal exposure

This occurrence was reported to CRH by letter dated June 23, 1989 from Mr. W. Costley to Mr. R. Manley, and a detailed description will not be repeated here. I agree with the NPI evaluation that the evidence points to an ingestion exposure and that the resulting dose was small, on the order of 40 millirem (50-year committed). I recommend improvement of future internal exposure evaluations by additional measurements to determine the relative importance of inhalation and ingestion pathways, even if the activity seems localized in the stomach or GI tract. This can be done easily by routinely taking a nose smear to determine whether or not significant inhalation exposure occurred. (Nose smears are not very good for quantitative estimation.) I also recommend that attempts to quantify internal depositions with a portable instrument be done at a low-background location with the distance between the detector and the source as great as possible to minimize uncertainties associated with source geometry and variation of the radiation field in the detector. I have reservations about the use of dust masks. They cannot be used with confidence for respiratory protection and I have experienced no situation in which the hazard of ingesting a particle has exceeded the hazard of inhaling an aerosol. The NPI situation may constitute such a new experience. If dust masks are used, careful training of operators will be necessary to make sure they understand that dust masks are not effective in protecting against inhalation hazards, that they have absolutely no connection to the respiratory protection program, and that the use of dust masks is permissible only when evaluation of anticipated changes in air concentrations leads to a judgment by the RSO that respiratory protection is not needed.

D. 6/22--81,000 dpm

A spot on the back of the knee of a worker became contaminated in the course of construction work on the new transition room.

In addition to the occurrences listed above, there were two occurrences that exceeded the level requiring notification of the RSO. Both barely exceeded the reporting threshold. One was clearly related to transition room construction. Incidents of contamination slightly above detection limits have been infrequent.

Work is underway to apply a correction factor to account for reduction in background due to body shielding. It was hoped that relocation of the counter might reduce the effective self-shielding. Although the orientation of the instrument should minimize the shielding effect of the body, self shielding is noticeable for large individuals. The effect of self-shielding is to suppress the background while the individual is counted. The suppression is typically about 5 cps for large individuals. This means that contamination levels of approximately 3,000 dpm are required to merely cancel the deficit in background and another 2,000 dpm are required to alarm the instrument. The detectors susceptible to this effect are the detectors near the trunk of the body.

The instrument software has provision for a self-shielding factor that can be applied to the background. A single value can be input for each detector. However, the appropriate self-shielding factor varies greatly between individuals and between orientations for a single individual, and it would be excessively time-consuming to change the eight factors for each count. The optimum solution to this problem is still under investigation. A modification in the technique, in the confidence level, or in the license limit may be necessary. In the interim, a minimum detectable level of activity on the hands of a large person may not be as low as 2,500 dpm is marginal. The minimum detectable level of activity on other body surfaces near the detector is about 5,000 dpm.

C.5 Courtyard Roof Design and Construction

I participated in a meeting with J. Ransohoff and F. Schwoerer on June 14 in which desirable design criteria and preliminary design concepts were discussed.

C.6 Hot Cell Ventilation System

The hot cell ventilation system evaluation was submitted as a separate report dated May 17, 1989. Additional information requested in the CRH letter dated June 22, is included in Addendum 1 to this report.

Conclusions

Based on my review of the operations, I conclude that NPI has undertaken a major change in the radiation protection aspects of its operations. This change is being implemented rapidly and, with minor exceptions, is being managed well.

I conclude that NPI is ready for successful handling of singly-encapsulated cobalt and for fabrication of bare cobalt components, subject to the following conditions:

- Additional decontamination of surfaces above the floor in the Hot Cell Access Room is required prior to operations that require the use of the door to the courtyard.

- Evaluation of frequent hot cell air samples during singly-encapsulated cobalt operations in the cell is required prior to operation with bare cobalt components.

- An RWP for removal of equipment from the Hot Equipment Room is required prior to removal of any equipment.



JEP 7/6/89

TABLE 1
FLOOR SMEAR SUMMARY
CLEAN SIDE OF LAA
JUNE, 1989

NUMBER OF SMEARS IN ACTIVITY RANGE (DPM/100 SQ CM)

| DAY | NUMBER OF SMEARS | <1,000 | 1,000 to 3,000 | 3,000 to 6,000 | >6,000 |
|---|---|---|---|---|---|
| 8 | 17 | 10 | 6 | 0 | 1 |
| 9 | 18 | 11 | 4 | 3 | 0 |
| 12 | 17 | 6 | 10 | 0 | 1 |
| 13 | 21 | 15 | 4 | 2 | 0 |
| 14 | 17 | 12 | 5 | 0 | 0 |
| 15 | 17 | 13 | 3 | 0 | 1 |
| 19 | 21 | 21 | 0 | 0 | 0 |
| 20 | 22 | 17 | 4 | 1 | 0 |
| 21 | 22 | 21 | 1 | 0 | 0 |
| 22 | 14 | 14 | 3 | 0 | 0 |
| 26 | 17 | 15 | 0 | 2 | 0 |
| 27 | 19 | 17 | 1 | 0 | 1 |

TABLE 2
FLOOR SMEAR SUMMARY
CONTAMINATION CONTROL ZONE
JUNE, 1989

SMEAR ACTIVITY RANGE AND MEDIAN (DPM/100 SQ CM)

| DAY | NUMBER OF SMEARS | ------RANGE------ | | MEDIAN |
|---|---|---|---|---|
| 8 | 6 | 13,000 | 99,000 | 50,000 |
| 9 | 6 | 7,500 | 23,000 | 18,000 |
| 12 | 6 | 5,000 | 256,000 | 9,000 |
| 13 | 4 | 1,700 | 9,100 | 5,000 |
| 14 | 6 | 3,700 | 12,000 | 5,400 |
| 15 | 6 | 2,000 | 52,000 | 4,000 |
| 19 | 3 | 1,000 | 1,200 | 1,000 |
| 20 | 5 | 1,000 | 5,600 | 1,600 |
| 21 | 5 | 1,000 | 20,000 | 2,100 |
| 22 | 6 | 1,000 | 10,000 | 2,000 |
| 26 | 6 | 2,800 | 9,000 | 6,600 |
| 27 | 5 | 1,000 | 8,100 | 3,000 |

ADDENDUM 1

RESPONSE TO CRH LETTER DATED 6/22/89, ITEMS C.1 AND C.6

C.1.b Respirator Maintenance

A thorough review of respirator maintenance procedures and practices will be conducted in the next reporting period. I propose to use NUREG-0041, Chapter 9, as a basis for evaluation. In my initial review, I examined several respirators and found them to be in good repair. I also inspected the room used for respirator maintenance and found that it was suitable for the NPI program.

C.1.c Signature of Procedures and Contamination Limits

Although I have signed one or two NPI procedures in the course of my review, I did so only with some misgivings and later decided that my signature of NPI procedures was inappropriate. I participated in the development of a number of procedures and reviewed and approved others. I believe I have been consulted appropriately in the development and approval of procedures. Rather than sign procedures, I would prefer to document my approval of a procedure or my comments on a procedure in a letter or signed memo. A copy could be forwarded to CRH as documentation of my review.

The CRH rejection of the NCRP recommendation of 75 microCurie-hours as a discrete particle exposure limit is not explained in the letter. The CRH adoption of USNRC Regulatory Guide 1.86 limits for fixed and removable contamination do not differ greatly from the value NPI proposed for fixed contamination release without follow-up monitoring and are acceptable to me.

C.1.d Releases not evaluated

A primary focus of the initial evaluation was to assure that significant release paths from the building were understood and controlled appropriately. Reports during the first evaluation period included an evaluation of the hot cell ventilation system and recommended modifications to the sampling system to increase confidence in effluent measurement results. Those recommendations were implemented and results from the new system, discussed in the attached report, show that releases through this pathway are negligible. I identified several potential paths and recommended control measures, which have been acted upon either by implementation of the recommendation or by implementation of an alternative measure considered to be appropriate. Based on experience in the current reporting period, I am confident that current releases from the plant are adequately identified and monitored and are within regulatory limits. Past releases from the facility to the environment and transport of that material beyond the restricted area are discussed in attached report.

C.1.f Contaminated Equipment Labeling

The item refers to a cart in the hot cell access room which contains contaminated tools (150 mR/hr at contact). This item is now labeled. This category will be added to future monthly reports. To prevent recurrence of this item, I recommend that procedures be reviewed and modified, if necessary, to require that materials and equipment in operating areas that constitute potentially significant contamination sources be decontaminated, wrapped or bagged in plastic, or contained in some other suitable way, and that they be labeled with a tag that states "CAUTION RADIOACTIVE MATERIAL" and provides radiation and contamination levels in accordance with 10 CFR Part 20.203f. Materials and equipment with fixed contamination need not be contained, but must be labeled. LAA operators will need to be informed of this procedure change, as is customary. I recommend that Health physics techs be reinstructed to look for inadequately identified radioactive materials and equipment, to note problems on contamination and radiation survey forms, and to make appropriate notifications.

C.1.f Waste Inventory and Storage Capacity

The waste inventory is quantified in the plan for radwaste disposal submitted separately to CRH. Implementation of the first shipment in the plan will free space for more than two years waste volume. Current storage is adequate for operations involving singly-encapsulated cobalt and the fabrication of sources from existing components. Waste volumes generated in those activities should be small. I have not yet evaluated the requirements of the next melting campaign.

C.1.i Training

I have been involved in development of the training program, have participated in some of the sessions intended to familiarize workers with new procedures, and have made specific training recommendations. Rather than signing training documents, I would prefer to provide evidence of my review in the form of a letter or memo, similar to that proposed for procedures in item C.1.c.

outlet is connected to the flow meter inlet by 3/8" tygon tubing approximately six inches in length. The flexible tubing permits opening the filter holder to change filter disks. The fittings used for the tubing connections are ribbed tubing fittings designed for tygon tubing. The flowmeter/pump/regulator assembly were purchased as a unit (model RAS-1) from Eberline Instrument Corp. The pump capacity is approximately 3 cfm, but the flowmeter can be used to regulate flow to a lower rate. All threaded connections are sealed with teflon tape. Glass fiber filter disks are used as a collection medium.

The selection of a single nozzle was based on ANSI Standard N13.1-1969.

The air flow is set at approximately 28 liters per minute. This is about a factor of two higher than the isokinetic flow rate of approximately 15 liters per minute. An isokinetic flow rate of 15 liters per minute, provides a sufficient sample volume in 24 hours to detect less than 3 percent of the cobalt-60 concentration limit for air in unrestricted areas, $3 \times 10^{-10}$ microCuries per cubic centimeter, a sufficient sensitivity. (The LLD estimate is based on a a 10-minute sample count time, and a lower limit of detection equivalent to 3 sigma for the net count of a sample with no activity.) NPI selected the higher flow rate to increase sensitivity after determining, based on ANSI Standard N13.1-1969, that the sampling error associated any particle size is no greater than a factor of two. The error is negligible for small particles likely to be of greatest concern.

The nozzle diameter and pump capacity were sized to permit isokinetic samples volumes sufficient to detect a small fraction of maximum permissible concentration in a 24-hour sample.

No quantitative leak testing of the sampling system was performed, but visual and physical inspection is sufficient to demonstrate that the few connections are sufficiently tight so that inleakage between the sampling point and the flow meter inlet is a negligibly small fraction of the system flow rate.

I judge the system design to be adequate.

3. Evaluation of Sampling Techniques and Frequency of Measurement

Five samples have been collected with the old and new sampling methodologies. All samples show concentrations much lower than the maximum permissible, and results are consistent between the two methodologies. Direct comparison is difficult because results from the new system are below statistical detection limits.

The sample collection frequency is normally weekly, but is increased to daily during operations with bare cobalt. Samples of work area air collected several times daily during P.2 operations showed that concentrations usually do not exceed permissible levels for unrestricted areas by a factor greater than two. Similar results should be expected for operations involving encapsulated cobalt. These samples provide a rough measure of airborne effluents from operations on a daily basis. They do not provide a measure of releases from the inventory in the ventilation system, but a long history of sampling shows that any releases from that inventory result in concentrations that are consistently far below regulatory limits. This would change only in the event of loss of filter integrity in each of the two HEPA filters. Such a failure would be a highly unlikely event that, in the most likely scenarios, would be detectable from regular observation of pressure drop across each of the filters. Therefore, weekly collection during operations that do not involve bare cobalt is reasonable. Concentrations in effluent from the system during operations involving bare cobalt are also typically far below regulatory limits. However, the potential for release is greater. Therefore, an increase in the sampling frequency to daily is a prudent measure.

4. Flowmeter Calibration

The flowmeter in use was calibrated by the manufacturer. I recommend that the flowmeter be added to the instrument calibration program and that the sampling procedure be modified to include a check of the calibration status on the "calibration due" sticker. I recommend that the calibration frequency be evaluated further. Quarterly calibration should be more than adequate. Annual calibration may be appropriate because of the non-corrosive, dust-free quality of the air sampled in this case.

5. Negative Pressure in the Hot Cell

Smoke tests that I conducted 7/3 indicate that air flows into the cell at a high velocity. Earlier informal tests using paper fibers with the door open also showed air flow into the cell. The most likely loss of ventilation through the hot cell would be loss of the hot cell fan or plugging of the roughing filter or either of the two HEPA filters. Each HEPA filter is equipped with continuous pressure differential measurement. Plugging of any of the filters, including the roughing filter, would change differential pressures across the HEPA filters, and loss of flow due to plugging would cause a high pressure differential condition if a HEPA filter was plugged and a low pressure differential if the roughing filter was plugged.

6. Confirmation of Backup Electrical Power Generator for Hot Cell Vent System

The backup electrical power generator is not yet connected, but new generating equipment is on site. I recommend that the new equipment be installed in a timely manner.

# Morton and Potter

10421 MASTERS TERRACE
POTOMAC, MARYLAND 20854

HENRY W. MORTON
10421 MASTERS TERRACE
POTOMAC, MARYLAND 20854
301-983-0365

THOMAS E. POTTER
4231 JENIFER STREET, N.W.
WASHINGTON, D.C. 20015
202-363-4727

July 6, 1989

Mr. J. A. Ransohoff, President
Neutron Products, Inc.
Dickerson, MD 20842

Dear Mr. Ransohoff:

This letter will confirm:

that I have participated in the development of the supplemental training program, and that I subscribe to the end product;

that I have participated in the development of the environmental surveillance program and believe it is adequate.

With regard to the training program, I am particularly pleased with the heavy emphasis directed to the review and understanding of procedures; and I believe that the round table nature of the review sessions is likely to insure the attention and active participation of all participants.

Sincerely,

Thomas E. Potter

Thomas E. Potter



TECHNICAL CONSULTANTS

SUPPLEMENTAL TRAINING PROGRAM FOR RADIATION PROTECTION PARTICIPANTS

July 6, 1989

## Scope

The purpose of this training program is to supplement, and in some cases supercede, existing Neutron Products' programs for the training of employees in Radiation Safety. Participants in the program will include all persons working in the Limited Access Area plus those who engage in environmental surveillance programs, either on-site or off-site. Moreover, it is the intent of the program defined hereby to comply with the requirements of Condition H of Amendment 33 to Neutron Products' license # MD 31-025-01.

## Context and Purpose

All Neutron employees receive an indoctrination, prior to beginning work in the plant, which introduces them to the hazardous nature of chemicals, radiation and radioactive isotopes. The indoctrination also provides basic guidance for safe conduct within the plant, with particular emphasis upon the operations within which the employee is most likely to be working.

More specialized and intensive training follows at the divisional level; and much of the training that Neutron's employees receive has been, and will continue to be, on-the-job training. Nevertheless, the company's training programs relative to radiation protection and environmental surveillance are considered too informal, and it is the purpose of this program to cure that deficiency.

Recognizing that different areas of responsibility require different types and levels of training, Neutron employees have been classified into 3 groups for the purpose of this program:

Limited Access Area workers and LAA Health Physics Technicians;

Environmental surveyors and area managers; and

Participants in specific tasks.

Some individuals may be in more than one group and, in such event, shall be trained in each group. The RSO shall maintain current written lists of all persons in each of the above groups and the Procedures for which they are authorized, either as a licensed user, or as an operator working under the supervision of the RSO or a licensed user.

## General Training

Employees in the first two groups shall attend periodic lectures (no less often than quarterly) with at least one lecture per quarter to be by the Health Physics Consultant. The focus of the lectures will be to provide and reinforce basic knowledge relating or useful in some way to understanding and applying the technology and practice of radiation safety. Some of the lectures may be supplemented by reading assignments.

Except for employees away from the facility on the day of the lecture, attendance at the Health Physics Consultant's lecture shall be mandatory for continued authorization to work in the Limited Access Area. Copies of the Health Physics Consultant's lesson plans shall be maintained for review by the Department along with attendance lists for each lecture.

The Training of LAA Workers and LAA Health Physics Technicians

LAA workers are those who regularly or frequently perform operational functions, health physics duties, maintenance tasks, engineering assignments, regulatory functions, and management functions in the LAA.

Health Physics Technicians shall be indentified in writing by the RSO, who shall assign specific responsibilities to qualified individuals, a partial summary of which comprises:

maintenance of the portal monitor (D.1);

ensuring proper use of the portal monitor (D.1);

monitoring the entrance and exit of persons to the LAA (D.2).

ensuring the proper use of hand held friskers by individuals who incur levels of contamination detected by the portal monitor (D.3);

reporting results of portal monitoring (D.4);

documenting probable sources of radiation contamination (D.5);

conducting plant surveys outside the LAA (D.6);

conducting water sampling of the main pool and waste water (D.7);

conducting environmental surveys (D.8);

conducting, documenting and reporting radiation surveys at courtyard gate (D.9);

supervising the donning, use and removal of protective clothing and respiratory protection equipment;

conducting and supervising facility decontamination activities;

monitoring and decontaminating tools and shipping containers; and

participating in or supervising waste packaging or waste shipping activities;

The primary task oriented training and review for the LAA workers and LAA Health Physics technicians shall be one to two hour round table reviews of procedures or technical background material involving the active participation of all (approximately 10) employees in these groups, the RSO, the Health Consultant, and cognisant radiation safety management personnel. These reviews shall initially be held no less often than twice a month, ultimately no less often than monthly. Each review will focus on one or two Procedures or radiation safety related topics, and appropriate written material to be read and understood before the review shall be distributed at least one week before each meeting. The scope of each procedural review shall include:

the contents of the Procedure(s) including operational details, action levels and action responses;

the history and purpose of the Procedure;

the potential hazards involved in performing the Procedure;

the margin, if any, provided by the Procedure against regulatory violations; and

the technical background, if any, required to understand the requirements of, and properly perform, the Procedure.

At the conclusion of each procedural review session, the Training Evaluation Committee, consisting of the RSO and two other top management persons to be appointed by the President shall:

revise the list of individuals authorized to perform the Procedure(s) reviewed; and

prepare a course of remedial action to qualify or requalify those individuals who are basically qualified, but lack complete understanding.

The RSO shall maintain a master list of all employees and the procedures which they are authorized to perform, and a current copy shall be posted in the clean room of the LAA.

In addition, each of the Health Physics Technicians shall be tested periodically, in the course of random inspections, on his understanding and performance of procedures for which he has been deemed qualified, and any training deficiencies remedied at the time or reported to the RSO.

In the course of its visits, Helgeson service personnel shall periodically test and reconfirm the qualifications of Health Physics Technicians authorized to maintain the portal monitor.

<u>Training of Environmental Surveyors and Area Managers</u>

The training program defined here is supplementary to training for primary responsibilities which are invariably performed outside the LAA. The environmental surveillance duties germaine to this program include:

the conduct of radiation surveys within the facility (D.6);

the conduct of on-site environmental surveys (D.8); and

the performance of off-site environmental surveys.

Area managers are those responsible for particular general plant areas that must be periodically surveyed. Environmental surveyors and area managers shall initially be trained by the RSO and the Health Physics Consultant in the course of one or more two hour training sessions. The training shall comprise:

instruction in the fundamentals of sampling and surveying for radioactive contamination;

instruction in the proper (and improper) use of instrumentation selected for specific missions;

instruction in the collection and labelling of specific samples;

instruction, where appropriate, in interacting with persons in the community that they are likely to encounter or serve in the course of off-site surveys; and

requirements for reporting and documentation.

Thereafter, the RSO, the HPC and the president will meet with the surveyors as a group, no less often than quarterly, to review results, share experiences, resolve operating problems, and reinforce technical and political (where appropriate) understanding.

The Health Physics Consultant, the Area Manager, if any, and the RSO shall initiate a list of qualified supervisors and surveyors that shall be maintained and administered by the RSO.

Specific Task Training

From time to time, persons who have other duties in the plant or in the management of the company, or who may be outside contractors, are called upon to participate in one or more activities within the LAA. The minimum training requirements for such persons are:

they shall have received the introductory lecture series on both radiation hazards and chemical toxicity (or the equivalent in the case of fire and rescue personnel);

they shall be instructed in the scope and requirements of the specific procedure(s) with which they are to be involved;

they shall be instructed in the proper use of radiation detectors that they will wear, and in the proper donning, wearing and removal of any protective clothing or respiratory apparatus that is required in the performance of the work;

they shall be briefed on the hazards, if any, associated with the area(s) in which they will work and the specific assignments they will be asked to perform;

they will be instructed on proper entrance and exit procedures; and

they will be introduced to the supervisor of the operation in which they are to participate, and said supervisor shall participate in the training.

Finally the participation and performance of each individual will be reviewed with him (her) and recorded in the Work Permit Log.

July 6, 1989

NEUTRON PRODUCTS, INC. - ENVIRONMENTAL SURVEILLANCE PLAN

July 6, 1989

## Introduction

The purpose of this document is to set forth a specific plan to implement the requirements of Sections D.8. and N of Amendment 33 for a program of environmental surveillance and remedial action.

Specifically, Condition D.8 of the amendment requires:

> a plan for "...the surveillance of radioactive contamination in surface and ground water at the plant's boundary and within one kilometer radius of the licensee's facility..."; and
>
> "...a decontamination plan, a schedule for remedial action and contingencies for obtaining access to private dwellings and commercial property."

Condition N requires:

> a plan for the ..."evaluation and remediation of ground areas surrounding the facility. This plan shall be approved by the Health Physics Consultant. Upon approval of the plan by the Department, said plan shall be implemented by the licensee. The criteria for acceptability of cobalt-60 contamination of ground areas are:
>
> 1. The gamma exposure at one (1) meter above the gound surface shall not exceed 10 micro R/hr above background for an area greater than 30 ft. by 30 ft. and shall not exceed 20 micro R/hr above background for any discrete area (i.e less than 30 ft. by 30 ft.).
>
> 2. The concentration limit for subsurface cobalt-60 contamination is 8 picocuries per gram above background for an equivalent area of 30 ft. by 30 ft."

## Characterization of the Site and its Environs

The location of Neutron's facility relative to its environs is shown on the appended abstracts from:

> the Montgomery County plot plan which locates private and commercial properties within 1 kilometer radius of the facility; and
>
> the USGS Topographical map which shows the surface features of the area (Photorevised 1988).

Approximately 120 private dwellings, five commercial properties, a church and a playground are located on 776 acres within a 1 kilometer radius from the center of the facility.

The surface waters within the 1 kilometer radius comprise:

those which may be contained from time to time within and immediately downstream of the dry pond at the southwest corner of the facility, and the drainage ditch of the railroad (not shown on the maps);

the water running in the creek that flows along Big Woods Road from the railroad overpass southward to Little Monocacy River; and

the waters of Little Monocacy River, which flows south of the facility from east to west and discharges to the Potomac River.

The facility is located above the New Oxford Formation where the ground water flow is primarily in joints, faults and bedding-plane partings in the rock.

Summary of the Plan

The purpose of this plan is to monitor and evaluate the contamination of soil, surface water and ground water within a kilometer of Neutron's plant, and to recover contamination from any sites that approach allowable limits. The plan is based on the intergration of a group of subsidiary monitoring programs, some of which are already in operation, others of which require development. Fundamentally, three different monitoring programs are contemplated:

one involves the systematic sampling of soil and groundwater on site and in the immediate vicinity of the plant;

another entails the "hot pursuit" monitoring and sampling of surface water and soil downstream of the plant; and

the other is directed to the random sampling of soil and groundwater on public and private property within a kilometer of the plant.

Recovery of activity shall be to the standard set forth in Condition N as a minimum. In addition, we will recover and remove sites of activity that exceed 50 nanocuries per square decimeter which are found in the course of surveys.

Immediate Vicinity Monitoring

The monitoring of soil and groundwater in the immediate vicinity of the plant can build on an established network of monitoring wells and sampling techniques.

Daily and monthly samples will continue to be taken, per Procedure R1002, from existing wells on Neutron's property.

In addition, we propose to take quarterly samples from the wells on the properties which are contiguous to the facility and the wells of nearby commercial properties, contingent on obtaining owners' approvals; and,

we propose annual monitoring of the wells on other properties located within a one kilometer radius of the facility, contingent on obtaining owners' approvals.

Because of the high level of pool integrity and the low mobility of cobalt in soils, the ground water monitoring program is undertaken as a precaution, and it may not provide substantive evidence of contamination.

In addition, both on-site and off-site soil will be monitored by surveys conducted at a height of one meter, using a survey meter that has been adjusted to be sensitive to photons in the energy range of cobalt-60 emissions.

Monitoring Soil and Surface Water

In contrast to the plan for general soil and ground water, the factors to be considered in monitoring surface water and soil subject to contamination by waterborne contamination indicate the use of a plan based on hot pursuit.

> Although we have strong evidence to support the conclusion that releases of airborne and waterborne contamination from the facility have been well within regulatory limits, we know that waterborne releases from the plant have resulted in the low level contamination of nearby soil, both on-site and off-site.
>
> The principal sources of surface water (and soil) contamination comprise roof drainage and courtyard drainage, with courtyard drainage presently considered to be the dominant contributor. In any case, both roof and courtyard drainage ultimately leave Neutron's primary property through the dry pond and flow into the leased field immediately downstream thereof.
>
> Thus, the primary sampling points are in the lines that carry roof drainage to the dry pond, the 60,000 gallon cistern in the basement of the building, and the line from the courtyard to the drypond. By sampling these sources, it may be possible to obtain an accurate estimate of the total release of activity - or failing that, it should be practical to establish that undetectable releases are well within regulatory limits. State of the art means of sampling are not known to be sufficient, and a development program may be required. How important is this capability to MDE?
>
> Even though releases were probably within limits, there is clearly a mechanism in effect that concentrates and retains waterborne activity that is released from the plant. In portions of the dry pond, and in portions of the field immediately downstream thereof, soil contamination levels are such that radiation levels exceed permissible values for decommissioning, a standard to which we have agreed to work in recovering released activity.
>
> Moreover, until we have removed the source of continuing release, hot pursuit monitoring is indicated.
>
>> Before the dry pond was built, substantially all of our waterborne releases were to the field downstream of the dry pond. Infrequent campaigns to remove contaminated soil from the low points served to maintain radiation levels at or below those now proscribed for remedial action; and there was no evidence of substantial flow downstream of the field.

However, the outflow from the dry pond provides a source of downstream erosion; and there is evidence that waterborne contamination has progressed westward a modest distance along the railroad ditch.

While there is little evidence or theory to substantiate a long trail, our monitoring program should provide for hot pursuit downstream from the dry pond effluent field to assure the substantial recovery of significant releases, and to document the full extent thereof.

Random Sampling

Supplementing the aforementioned programs is a random sampling program of ground water and soil within a one kilometer radius of the plant. A high priority of the random sampling program is to show due consideration and empathy to those property owners who are concerned enough to request a survey if invited to do so. However, any such survey, whether it be of a well water sample, a garden, or a crop field, shall be performed and documented in such a way that it also serves as a random sample of the nearby community.

Tools, Techniques and Samples

All ground water samples will be collected in clean containers in accordance with an implementing procedure, and will be first counted at Neutron, then by the Department if either the Department or the neighbor so requests. To the extent that we are going to all that trouble, it might be appropriate to account for radon daughters as well, and the cooperation of the Department in that regard is respectfully requested.

Except in unusual circumstances, soil samples are taken with a cup cutter to a depth of four inches, and carefully packaged in a plastic bag for counting in a shielded well counter and possible additional analysis.

A survey meter set for maximum sensitivity at the cobalt-60 peaks is the indicated instrument for soil and surface water surveys, and the height of routine survey measurement shall be set at one meter. When a differential over background of more than 5 microR/hr is clearly indicated, a more careful local survey shall be conducted by probe at a height of about 5 cm above grade. Any site of activity exceeding 50 nanocuries per square decimeter of surface shall be removed with the cup cutter, and returned to the plant for analysis.

In addition, in hot pursuit, 5 cm surveys shall be performed, and soil samples taken for a distance of not less than 10 meters after the trail is lost by surveying at a height of 1 meter.

Documentation

All surveys shall be documented with the location of samples identified, and radiation background levels recorded on a one meter by one meter grid. Samples and survey documents shall be numbered, dated and signed by the surveyor. Any survey readings in excess of 10 microR/hour shall be called to the attention of the RSO or his designee promptly at the conclusion of the survey.

## Reporting

The RSO shall be immediately notified at the conclusion of any survey that encounters a one meter high exposure rate in excess of 10 microR/hr;

a copy of the exposure rate maps shall be given to, and discussed with, the RSO within one workday after the completion of each survey;

the Department shall be notified within 24 hours whenever the exposure rate exceeds the limits set forth for remedial action in Condition N of Amendment 33.
The RSO shall be immediately notified whenever the activity of a ground water sample exceeds 3E-6 microcuries/cc.

MDE shall be notified within 24 hours of any ground water sample that exceeds 3E-5 microcuries/cc.

## Access to Private Property

Once we have indication of the general acceptability of this plan, we will undertake three approaches to obtaining necessary access to private property.

Management personnel will contact the church, the owners of commercial establishments, and our immediate neighbors to personally explain the surveillance program and request access for the purpose of making site surveys, taking soil samples when appropriate, and obtaining well water samples.

We will request written authorization from the Chessie system to fence and maintain the leased field downstream of the dry pond so that we can control access to an area, portions of which are likely to exceed standards for uncontrolled access. The purpose of said authorization is not to avoid or delay decontamination proceedings, but to have the ability to organize them efficiently.

We shall write the other property owners within the 1 kilometer radius inviting them to participate in our random survey.

## Remedial Action

The removal of several drums of soil is required from portions of the dry pond and the field downstream thereof. Detailed surveys will begin promptly upon CRH agreement with the essence of this plan, and a decontamination plan will be detailed during the course of said surveys.

We are not aware of any other prospective decontamination requirements.

PORTION OF

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

POOLESVILLE QUADRANGLE
MARYLAND–VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)