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TELEDYNE
ISOTOPES

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IWL-0032-365

QUALITY CONTROL
INTERNAL CONTROLS AND AUDITS
ENVIRONMENTAL ANALYSIS DEPARTMENT
IWL-0032-365

TELEDYNE ISOTOPES
50 VAN BUREN AVENUE
WESTWOOD, NEW JERSEY 07675



COPY NO.: 111
ISSUED TO: S. Huggins
ISSUE DATE: 11/14/90

91122131041

DOCUMENT ISSUE AND REVISION CONTROL FORM

DOCUMENT: Quality Control: Internal Controls and Audits

SECTION: Environmental Analysis Department T.I. NUMBER: IWL-0032-365

COVERAGE: _____

| ISSUE AND REVISIONS | PAGES | PREPARED | | EFFECTIVE DATE | APPROVED BY |
|---------------------------|---|---------------------------|-----------------|-------------------|------------------|
| | | BY | DATE | | |
| Revision | v,xiii, 1.2,2.3, 2.4,4.1, 4.4,4.9, 4.23,5.1, 5.2,6.1,7.1, 9.1,10.2, 10.3, 10.4 11.2, 11.3 | H. King <i>H. King</i> | October 1987 | 10/87 | <i>J. Martin</i> |

91122131842

DOCUMENT DISTRIBUTION CONTROL FORM

DOCUMENT NO. IWL-0032-365 ISSUED BY: J. DAVID MARTIN

EFFECTIVE
DATE 10/87

TITLE: QUALITY CONTROL: INTERNAL CONTROLS AND AUDITS,
ENVIRONMENTAL ANALYSIS DEPARTMENT

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AUTHORIZATION AND APPROVAL

The Quality Control and Assurance program defined herein has been approved by the Management of Teledyne Isotopes and Teledyne Isotopes Midwest Laboratory and the Quality Assurance Manager has been authorized to develop and implement the procedure required to attain these goals.

This Quality Control Program defines quality related operations of the Environmental Analysis Department of Teledyne Isotopes and Teledyne Isotopes Midwest Laboratory.

Department Manager: J. David Martin
J. David Martin

The Quality Assurance Manager is: Barbara I. Campbell
Barbara I. Campbell

Authorized by: Donald F. Schutz
Donald F. Schutz
President
Teledyne Isotopes

Date: October 26, 1987

QUALITY ASSURANCE - INTERNAL CONTROLS AND AUDITS

This manual contains the quality control procedures that must be followed in the laboratories performing analyses for radioactive isotopes on environmental media for monitoring the activity in the vicinity of nuclear reactors. The basic requirements apply to all laboratories where practicable. The additional quality control and quality assurance manuals issued by Teledyne Isotopes are as follow:

1. IWL-0032-361
Environmental Radiation Monitoring Quality Control Manual
Intercomparison Checks
2. IWL-0032-395
Environmental Radiation Monitoring Quality Assurance Manual
Compliance with CFR 50 Appendix B and Regulatory Guide 4.15
3. IWL-0092-416
TLD Personnel Badge Service Quality Control Manual
4. IWL-0032-419
Analytical Procedures Handbook
5. IWL-0052-420
Radiocarbon Age Determination Quality Control Procedures
6. IWL-0782-439
Phosphor Production Quality Control Manual
7. IWL-0092-441
TLD Environmental Badge Service Quality Control Manual
8. IWL-0092-442
TLD Badge Service Quality Assurance Manual
Compliance with 10 CFR 50 Appendix B and Regulatory Guide 4.13
9. IWL-0122-462
Quality Assurance Manual Nuclear Fuels -- Mass Spectrometry
Compliance with 10 CFR 70.57(b)
10. IWL-0782-439
Quality Control Manual for TL Phosphor Production and TLD Badge
Assembly

INTRODUCTION

The purpose of this Quality Control Manual is to prescribe the procedures approved by the management of Teledyne Isotopes for implementing the provisions of government regulations 10 CFR 50, Appendix B and Regulatory Guide 4.15. Specified in 10 CFR 50, Appendix B and Regulatory Guide 4.15 are the criteria establishing the basis for quality assurance that must be applied to the production and/or analytical service operations at Teledyne Isotopes to assure the quality of the results of measurements of radioactive materials in the effluents and the environment outside of nuclear facilities. Included in this document is information pertaining to the managerial and administrative controls used to assure quality and safe operations.

In prescribing this quality control program, the objectives of management are to assure that the quality of the products produced and the services performed equal or exceed specifications, are performed under controlled conditions to predetermined requirements, and can be verified by adequate documentation. Attainment of these objectives is basic to the success of Teledyne Isotopes in the production of quality products and the performance of quality services.

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referred to in applicable section of manual.

1. PRO-032-27 Calibration and Control of Alpha and Beta Counters
2. PRO-042-44 Calibration of Ge(Li) Gamma Ray Spectrometers
3. PRO-032-48 Procedure for Receipt of Samples
4. PRO-032-49 Standardization of Radiochemical Carrier Solutions
5. PRO-052-50 Calibration of Gas Counters for Tritium Analysis
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7. PRO-032-59 Investigation of Abnormal Results
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1.1 Policy

The management of Teledyne Isotopes is committed to the establishment of the program prescribed in this quality control manual. To develop, implement and update the quality control programs, management establishes the position of quality assurance manager.

1.2 Authority

Authority and organizational freedom are granted to the quality assurance manager to:

- 1.2.1 Identify quality problems.
- 1.2.2 Initiate, recommend and provide solutions.
- 1.2.3 Verify implementation.
- 1.2.4 Report to president of the company problems adverse to quality requiring executive action or a work stoppage of a laboratory.

1.3 General Duties of Quality Assurance Manager

- 1.3.1 Performing the functions of attaining quality.
- 1.3.2 Assuring that an appropriate program is established and executed.
- 1.3.3 Verifying the program by internal audits.
- 1.3.4 Assuring that sufficient controls and calibrations are executed to specify the degree of confidence of the data generated.
- 1.3.5 Assuring that all programs are documented and controlled.
- 1.3.6 The quality assurance manager shall give annual written reports to the president of Teledyne Isotopes regarding the status of the quality assurance program and any problems encountered as to quality. Any recurrent problems and corrective actions necessary shall be discussed.

1.4 Authorities, Duties and Responsibilities of Positions of Management

Attached is a chart of the company showing relationships of management personnel in regard to quality assurance. See Figure 1, page 1.7. The duties of the various levels of supervision are:

1.4.1 President

1. Support quality assurance functions.
2. Take action if a condition is found adverse to quality and has not been acted on by responsible personnel.

1.4.2 Quality Assurance Manager

1. Carry out the general duties of Section 1.3.
2. Approve the data before being entered into computer. (May be done by designated representative.)
3. Recommend Corrective Actions if necessary. Inform personnel involved directly or by department meetings.
4. Approve all data reports before being sent to contractor. (May be done by a qualified designated representative.)
5. Analyze results of spiked, blank and replicate samples.
6. Analyze results of EPA samples.
7. Conduct Internal Audits as described in Section 12.0.
8. Assist in audit by contractors.
9. Check and approve procedures.
10. Write and revise quality assurance and quality control manuals and forms.
11. Train in quality assurance functions.
12. Set and/or approve acceptance criteria for laboratory equipment and practices.

1.4.3 Technical Vice President

1. Make final check of all results for accuracy before they are mailed to contractor. (May be done by a qualified designated representative. The final report to the customer shall be signed by either the technical vice president, the quality assurance manager or a qualified designate.)

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2. Inform contractor of all results not within limits and nonstandard results. (May be done by a qualified designated representatives.)
3. Supervise establishment of contractor's program.
4. Hire personnel.
5. Design and/or supply necessary equipment.
6. Write and establish procedures as required.
7. Approve all procedures.
8. Assist in audits by contractors.
9. Take action in problems arising in the laboratories.

1.4.4 Department Manager

1. Provide quality control of all analytical results.
2. Write and establish analytical procedures.
3. Write and document programs for calculating results.
4. Check backgrounds and standards of radiation measuring equipment.
5. Take action if results are not within prescribed limits.
6. Establish counter efficiencies traceable to NBS standards.
7. Hire personnel sufficient to handle sample work load.
8. See that equipment is maintained.
9. Assist in training personnel.
10. Provide general supervision to assure good laboratory practice is followed.
11. Assist in audits by contractors.

1.5 Duties and Responsibilities of Laboratory Personnel

1.5.1 Laboratory Supervisor

1. Ensure that analytical procedures are followed.
2. Assist the laboratory manager in maintaining quality control.

3. Inspect laboratory notebooks.
4. Train personnel.
5. Schedule work of laboratory including quality control samples.
6. See that good laboratory and housekeeping practices are followed.
7. Inform management of any problems, need for equipment, equipment maintenance or personnel.
8. Order necessary supplies.
9. Assist in maintenance of equipment.
10. Inspect work of technicians at hold points necessary to assure accurate analyses.
11. Take corrective action required by audits and results as reviewed by quality assurance manager.

1.5.2 Laboratory Technician

1. Perform analyses as assigned in exact accordance with procedures and as trained by supervisor.
2. Follow good laboratory practices and maintain clean, organized work area.
3. Put all data in laboratory notebook according to correct T.I. number with analysis, date of analysis and data necessary to trace accuracy of measurements. Initial notebook when data for samples being analyzed is complete.
4. Prepare work sheet for counting room containing the Sample Number, the analyses performed, the collection dates, the mounting date, yields and all information called for. Deliver work sheets and samples to counting room.
5. Inform supervisor of supplies required and any problems with equipment used.
6. Calibrate any equipment used which will affect the accuracy of the measurements being made.
7. Perform quality assurance spiked, blank and replicate samples as required for recertification against known results. (These shall not be indicated to the technician.)

8. Follow good safety practices including knowledge of fire regulations and actions required in case of acid spill or radioactive spill.

1.5.3 Counting Room Technician

1. Schedule counting so that delivery dates for data may be met.
2. Calculate activity of sample from data on programmed computer or other specified method.
3. Decay check positive results for purity after approximately one-half of the half-life of nuclide.
4. Count samples for a sufficient period of time to meet technical specifications of customer.
5. Confirm results which are suspected of being higher or lower than similar samples.
6. Submit data for entry into computer after approval by Quality Assurance manager or Laboratory manager.
7. Edit disc of results which have not been approved and initial printout of data being submitted.
8. Read and record in log provided, check sources daily or as required on specific counting device.
9. Check and record in log provided, backgrounds on specified counting device once a week or more frequently if possible.
10. Graph results of check sources and inform laboratory manager if results appear to be out of control limits specified.
11. Graph results of backgrounds for all counting equipment and inform laboratory manager if they appear to be out of control.
12. File original data sheets for period specified by contractor.

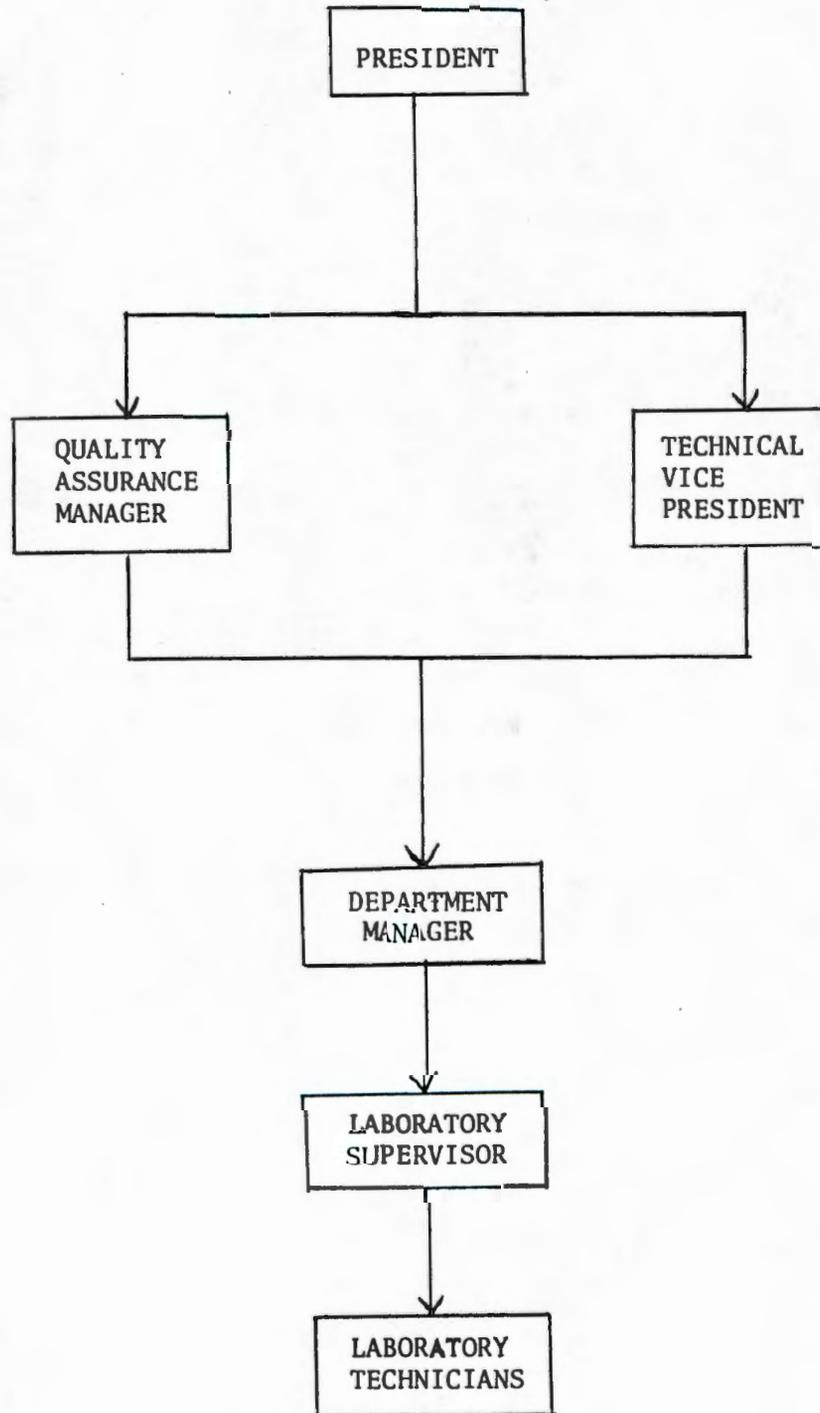
1.5.4 Supervisor of Gamma Ray Spectroscopy Laboratory

1. The scheduling of sample preparation, counting and data reduction to be performed in an orderly and timely manner so that data may be tabulated for submission to the computer prior to the mailing due date.

The sample bottling will principally be performed by assisting technicians but final responsibility is on the laboratory supervisor.

2. Perform the weekly air particulate filter geometry calibration and weekly liquid nitrogen filling of dewars.
3. Perform background measurements at least once every two weeks.
4. Perform special requests for data reduction and sample counting as needed.
5. Assist in sample changes on weekends and occasionally on week nights if needed.
6. Maintain an adequate supply of paper tape for the Nuclear Data system, 150 ml and 300 ml bottles, teletype paper and ribbon, magnetic tape cassettes (and proper format for use), and other laboratory supplies as required to keep an orderly flow of data.
7. Perform other duties which may be specified by the manager of the Environmental Analysis Department.
8. Perform energy resolution and counting rate measurements once a week and chart results. Inform supervisor if these are not within prescribed limits.

Figure 1



MANAGEMENT ORGANIZATION FOR QUALITY ASSURANCE

SECTION 2.0 QUALITY ASSURANCE PROGRAM

The quality assurance program is designed to provide the necessary procedures and actions taken to ensure that results obtained are accurate, precise and valid.

2.1 The Objectives are:

- 2.1.1 To assure that technical personnel are qualified and adequately trained.
- 2.1.2 To provide assurance that methods and procedures are documented and approved.
- 2.1.3 To ensure that the required QA/QC documentation is generated and that records are adequate and complete.
- 2.1.4 To assure that prompt corrective action measures are implemented to correct conditions of unacceptable quality.
- 2.1.5 To provide a quality assurance documentation file which is identifiable and traceable to all items.
- 2.1.6 To provide for training and certification of personnel.

2.2 A training program shall provide for the following:

- 2.2.1 Personnel performing quality related activities are to be trained and qualified in the principles and techniques of the activities they perform.
- 2.2.2 Personnel shall be made aware of the nature and goals of the quality assurance program.
- 2.2.3 Proficiency of personnel shall be maintained by retraining or by periodic performance reviews.

2.3 The process of certifying personnel shall include the following steps:

- 2.3.1 The educational background and work history of each employee shall be on file in the personnel office and shall be available for inspection by authorized supervisory personnel.
- 2.3.2 Preparation of Certification of Personnel Form IWL-19A, a copy of which is attached, for each employee upon reporting for work. This shall include a description and the number of the procedures for which the employee is being trained and the person who is training them.

- 2.3.3 Familiarization of the employee with the written procedure. A copy of the written procedures for which a technician is certified shall be available in the work area.
- 2.3.4 Observation of the actual procedures as performed by a qualified analyst.
- 2.3.5 Performance of the procedure under the instructions of a qualified analyst.
- 2.3.6 Demonstration of competence in the procedure by performance of representative samples or processes with the attainment of the specified precision and accuracy.

2.4 Evaluation of Personnel Form

An evaluation of Personnel Form IWL-19B, a copy of which is attached shall be filled out and updated at least once a year for each employee. Any additional training received inside or outside of the company shall be entered. The review shall include observation of the technician on the job for good laboratory techniques and knowledge of the job. If no significant change has occurred during the year the update of the certification may be accomplished by a statement that no change has occurred which shall be signed and dated by a supervisor.

2.5 Analysis of Standards and Blanks

To satisfy the requirements in Regulatory Guide 4.15, Section 6.3 standards and blanks similar to the samples must be analyzed regularly. This procedure also constitutes a repeated performance review of the analyst. If spiked sample data exceeds the predetermined control limits, the count is first checked by recounting the sample or by checking the counter control readings. If this does not reveal the problem, sample preparation and/or chemistry is investigated and the sample shall be reanalyzed. Results of the investigation are to be documented on the data sheet. The results of

low or high trends in the results of QA spiked samples shall be investigated and documented.

2.6 Continuing Training

A continuing program of training and upgrading of skills is necessary for quality work. Each manager and each supervisor is encouraged to provide training materials and a training program for technicians.

2.7 Quality Assurance Training

All supervisors shall be acquainted with the Teledyne Isotopes quality assurance policies and program, and the applicable government regulations. They shall be responsible for the training of the personnel under their supervision in quality assurance.

2.8 Qualification of Personnel

2.8.1 Managerial Personnel

A bachelor or advanced degree in engineering, science or mathematics from an accredited institution plus five years or more experience in the nuclear field or equivalent technical experience.

2.8.2 Laboratory Supervisor or Group Leaders

A bachelor or associate degree in engineering, science or mathematics from an accredited institution plus one year or more of experience in the nuclear or equivalent technical experience. This may be superceded by an equivalent combination of science training and work experience in the nuclear or scientific field.

2.8.3 Senior Associate Scientist, Associate Scientist, Senior Laboratory Technician, Assistant Scientist

A bachelor or associate degree in engineering, science or mathematics from an accredited institution or an equivalent combination of science training and work experience in the nuclear or scientific field.

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2.8.4 Laboratory Technician or Data Clerk
High School graduate or the equivalent.

2.9 Radiation Safety

The regulations relating to the reporting of defects and non compliances as related to conditions hazardous to safety as specified in 10 CFR 21 are posted on the bulletin board along with Section 206 of the Energy Reorganization Act of 1974. The method of making a report of conditions hazardous to safety is described in "Radiation Safety Code and Quality Control Manual", August 1984, Section II, 1.3.3 and 1.3.4.

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CERTIFICATION OF LABORATORY PERSONNEL

NAME _____ EMPLOYEE NO. _____

HIRED AS _____ DATE _____ CODE NO. _____

THIS EMPLOYEE IS BEING TRAINED TO PERFORM THE FOLLOWING PROCEDURES:

THIS EMPLOYEE HAS BEEN CERTIFIED

| DESCRIPTION OF PROCEDURE/TASK | LABORATORY | TRAINED BY | RECEIVED WRITTEN PROCEDURE | DATE | CERTIFIED BY | DATE |
|-------------------------------|------------|------------|----------------------------|------|--------------|------|
| | | | PRO- | | | |
| | | | PRO- | | | |
| | | | PRO- | | | |
| | | | PRO- | | | |
| | | | PRO- | | | |

I have received training in quality control and understand its importance in assuring reliable analytical results:

Signature of Technician

Date

9 1 1 2 2 1 1 0 6 6 1

EVALUATION OF LABORATORY PERSONNEL

NAME _____ EMPLOYEE NO. _____

PRESENT POSITION _____ CODE NO. _____

DATE _____ 19 _____ REVIEWED BY _____

ADDITIONAL TRAINING AND/OR SKILLS: _____

TECHNICAL COMPETENCE

FOLLOWS PROCEDURE _____

TECHNIQUE _____

HOUSEKEEPING _____

COMMENTS _____

DATE _____ 19 _____ REVIEWED BY _____

ADDITIONAL TRAINING AND/OR SKILLS _____

TECHNICAL COMPETENCE

FOLLOWS PROCEDURE _____

TECHNIQUE _____

HOUSEKEEPING _____

COMMENTS _____

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SECTION 3.0 PROCUREMENT AND CONTROL OF REAGENTS,
MATERIALS, SUPPLIES AND SERVICES

Objectives:

This control describes the procedure to assure the quality and composition of reagents, materials, supplies and services purchased or otherwise obtained for radiochemical analysis; to control the identification and traceability to the source or the supplier of reagents and supplies and control the dating of reagents to assure discard at the expiration of shelf life period.

3.1 Instructions for use of the Reagent Control System

Purchase of reagents must comply with Section 7 of the Quality Assurance Manual (IWL-0032-395). It is the responsibility of the laboratory manager to specify reagents, materials, supplies and services of reliable quality based on his experience and upon accepted practice in the industry.

3.1.1 The purchase of reagents, materials, supplies, and services must be initiated by preparing a Teledyne Isotopes purchase requisition obtained from the purchasing agent. The laboratory supervisor must initial and date each purchase requisition.

3.1.2 All entries on the purchase requisition must be completed to clearly identify the item, quantity, specification, source, approximate cost, and manufacturer. Any special quality criteria or performance requirements shall be clearly specified. An audit of the supplier shall be conducted if considered necessary by the department manager.

3.1.3 The purchase requisition must be reviewed and approved by the laboratory manager.

3.1.4 If the cost of the purchased item exceeds a specific limit, additional signatures of management are required.

3.1.5 The completed and approved purchase requisition is then submitted to the purchasing office for processing in accordance with Section 7 of the Quality Assurance Manual.

3.1.6 The laboratory supervisor will retain a copy of each purchase requisition. Upon receipt of the ordered material he must verify the quantity and specification of each item and indicate acceptance in writing on his copy of the purchase requisition. The reagents and chemicals received shall be marked with the date of receipt in order to maintain traceability and shelf life control.

3.1.7 The purchasing agent must notify the department manager of any changes in the specification, source, price and delivery of the items listed on the requisition. No changes or substitutes may be made without the approval of the department manager.

3.1.8 Copies of purchase requisitions must be retained in the laboratory for a period of 5 years to assure traceability of purchased materials.

3.1.9 See the accompanying copies of the Teledyne Isotopes Purchase Requisition (sample copy attached) page 3.4 from which the purchasing department will prepare purchase order (sample copy attached) page 3.5.

3.2 Acceptance

3.2.1 Acceptance of a procured item shall be based on conformance to recognized quality, previous performance and grade as specified in purchase requisition and shall show no adverse reactions when used for analysis of blanks and spiked samples. Any chemicals or reagents showing adverse results

shall be indicated clearly as "Not To Be Used", removed immediately from use and returned to supplier or discarded.

3.2.2 Purchase orders for new measuring equipment shall be originated by the laboratory supervisor or manager and shall be calibrated and accepted in accordance with the criteria as specified in the purchase order and the manufacturers specifications.

3.3 Shelf Life Control

3.3.1 Shelf life control of prepared reagents (quantitative dilutions of salts used as carriers and reagents) is maintained through use of reagent control labels. Each time a quantitative dilution is made, a reagent control label is filled out and affixed to the reagent bottle. The reagent must be discarded two years after the dilution date unless otherwise recommended by the manufacturer. See attached copy of Reagent Control Label (IWL-13) which is to be filled out completely and attached to the material concerned.

3.3.2 Shelf life control of bottled chemical salts and liquids is maintained by writing the receipt date on the container. These materials must be discarded after the shelf life period indicated by the manufacturer. If no shelf life period is recommended by the manufacturer, the laboratory manager will decide if the material should be discarded because of degeneration.

3.4 Services

All mechanical and electronic components and instruments that cannot be repaired in-house are repaired and serviced by the manufacturer or a qualified representative. Components must meet the original manufacturers' specifications prior to acceptance and use. Instruments that require scheduled maintenance and calibration are to be serviced by the manufacturer

or a qualified representative and documented.

3.5 Standards

All radionuclide standards used shall have been certified by NBS or obtained from suppliers who participate in measurement assurance activities with NBS when such standards are available. In these measurement assurance activities, the supplier's calibration value shall agree with the NBS value within the overall uncertainty stated by the supplier in its certification of the same batch of sources when these are sampled for measurement by NBS or in its certification of similar sources. Acceptable standards for certain radionuclides may be prepared from commercially available high purity chemicals. All standards are to be stored in a tamper-proof secured area to ensure their integrity. Certificates for all standards are to be maintained on file. Dilution of standards shall be prepared according to procedure PRO-032-27. A record of the method of dilution and calculation of the activity of the diluted standard shall be maintained by the person preparing the dilution. The calculation of the activity of the diluted standard shall be checked by someone other than the person preparing the dilution. The prepared standard shall be labeled so as to maintain traceability.

TELEDYNE ISOTOPES

50 VAN BUREN AVENUE
WESTWOOD, NEW JERSEY 07675
AREA CODE 201 - 664-7070

PURCHASE ORDER

DATE _____ PAGE _____ OF _____

| | |
|--|---------------|
| PURCHASE ORDER NO. | AMENDMENT NO. |
| Above Number Must Appear On All Invoices Packages, Packing Slips, Correspondence, Etc. | |

SHIP TO: 50 Van Buren Ave., Westwood, N. J.

Att: _____

TO

ATT:

MAIL INVOICES IN DUPLICATE TO ABOVE ADDRESS, ATT. ACCOUNTING DEPT.

| | | | | | |
|--------------|-------------|-----------|----------|---|----------|
| CONTRACT NO. | D.O. RATING | TERMS | F.O.B. | TAX EXEMPT: 221-831-201 <input type="checkbox"/> YES <input type="checkbox"/> NO | SHIP VIA |
| WILL SHIP | ORIGINATOR | ACCT. NO. | REQ. NO. | G.P. | |

| ITEM NO. | QUANTITY | PART NO. | DESCRIPTION | UNIT PRICE | TOTAL |
|----------|----------|----------|---|------------|-------|
| | | | Confirming telecon order of _____ to _____ Any changes of/or additions to these terms and conditions thereafter transmitted by the Seller in any manner, will not bind Isotopes unless consented to in writing. | | |

The Seller certifies and warrants that the supplies delivered under this purchase order conform in all respects with the Occupational Safety and Health Act of 1970 and applicable regulations and standards promulgated thereunder. In the event that such supplies do not conform in all respects with the Occupational Safety and Health Act of 1970 and applicable regulations and standards promulgated thereunder, the seller covenants and agrees that it will at its own cost, modify or replace such supplies in order to effect conformance.

TOTAL \$:

NOTE REQUIREMENTS CHECKED:

- CERTIFICATE OF CHEMICAL & PHYSICAL ANALYSIS IN TRIPLICATE MUST ACCOMPANY SHIPMENT. SUBMIT IN TRIPLICATE TO ATT. OF PURCHASING DEPT.
- CERTIFICATE OF COMPLIANCE TO SPECIFICATIONS MUST ACCOMPANY SHIPMENT. SUBMIT IN TRIPLICATE TO ATT. OF PURCHASING DEPT.
- EXCESS QUANTITIES WILL BE ACCEPTED ON A NO-CHARGE BASIS ONLY.
-

ISOTOPES

SELLER NOTE-- BY ACCEPTING THIS ORDER THE SELLER AGREES TO PERFORM IN ACCORDANCE WITH THE SPECIFICATIONS AND TERMS AND CONDITIONS SET FORTH ON BOTH SIDES OF THIS ORDER. SIGN AND RETURN ATTACHED ACKNOWLEDGEMENT COPY IMMEDIATELY TO AVOID CANCELLATION.

PURCHASING DEPARTMENT

PURCHASING NUMERICAL

9112200181731

REAGENT CONTROL LABEL (gummed back)

(Attached to bottle or container containing reagent)

| | |
|-------------------------------------|----------------------|
| REAGENT CONTROL - TELEDYNE ISOTOPES | |
| REAGENT _____ | CONTROL NO _____ (1) |
| CATALOG OR CERTIFICATE NO _____ | P.O. NO _____ |
| SUPPLIER _____ | ANALYST _____ |
| USE _____ | DATE _____ |
| REFERENCE _____ | |
| DESCRIPTION (2) | |

(1) Control number (9 digits)

| | | | | | | | | |
|----------|--|--|-------|--|-----|--|------|--|
| | | | | | | | | |
| Lab. No. | | | Month | | Day | | year | |

(2) Details of dilutions or additions to the reagent contained in bottle or container.

SECTION 4.0 SAMPLE RECEIPTING AND REPORTING CONTROL

This control details the forms used and the data flow for receipt and reporting of samples to assure sample integrity from time of receipt of sample to reporting the results to the contractor. Attached is a figure of the Flow Chart of sample from time of receipt to report of results to contractor. See Figure 2, page 4.4.

4.1 Control for Sample Receipting

4.1.1 Upon receipt of a sample batch the sample receipt technician shall compare the packing list with the samples received and verify that all samples are received as listed. Any discrepancies shall be reported immediately to the supervisor for resolution. The directions as outlined in PRO-032-48 shall be followed. Shipping containers which bear a radioactive label shall be surveyed by a qualified technician in accordance with the Radiation Safety Code and Quality Control Manual IWL-0312-451, Section 2, Paragraph 4.3. The shipping/receiving area is equipped with a fixed survey meter.

4.1.2 Sample receipt form (IWL-1) is available to customers with instructions for their use in identifying and describing samples and the analyses required. Instructions for proper shipping of samples to avoid damage and contamination are available also. Approved containers may be supplied if required.

10/87

4.1.3 Copies of the radiological environmental monitoring program (REMP) of each contractor shall be available in the sample receiving group. The sample receipt form shall be compared with the REMP of the contractor. The supervisor shall be informed of any discrepancies and any differences resolved.

4.1.4 The sample shall be logged in an appropriate notebook and a Teledyne Isotopes number assigned. The Teledyne Isotopes number shall be carried with the sample throughout the process. In-plant samples shall be separated from environmental samples to prevent contamination. All samples shall be stored so as to preserve identification and to prevent spoilage and cross contamination. They shall be stored as long as required by the contractor or until it is clear that there is no further need for reanalysis.

4.2 Sample Preparation

4.2.1 The computer shall prepare a work order from the sample receipt form, a copy of which is sent to the customer and accounting. Computer printouts with work orders in numerical order shall be sent to each laboratory manager.

4.2.2 After receiving sample receipt form, laboratory technician or supervisor shall pick up sample and process as required in accordance with approved Teledyne Isotopes procedures. These procedures are contained in Analytical Procedures Handbook PRO-032-419. All pertinent data shall be listed in the laboratory notebook with sample number, date and initials of technician performing analysis. Laboratory notebooks shall be checked for accuracy and signed at least once per month by a supervisor or a qualified designate. Preparation of carrier solutions shall be documented in appropriate notebook. All carrier solutions shall be labeled and be traceable to original preparation. They shall be restandardized every six months after original standardization until depletion or discard. This procedure is described in PRO-032-49.

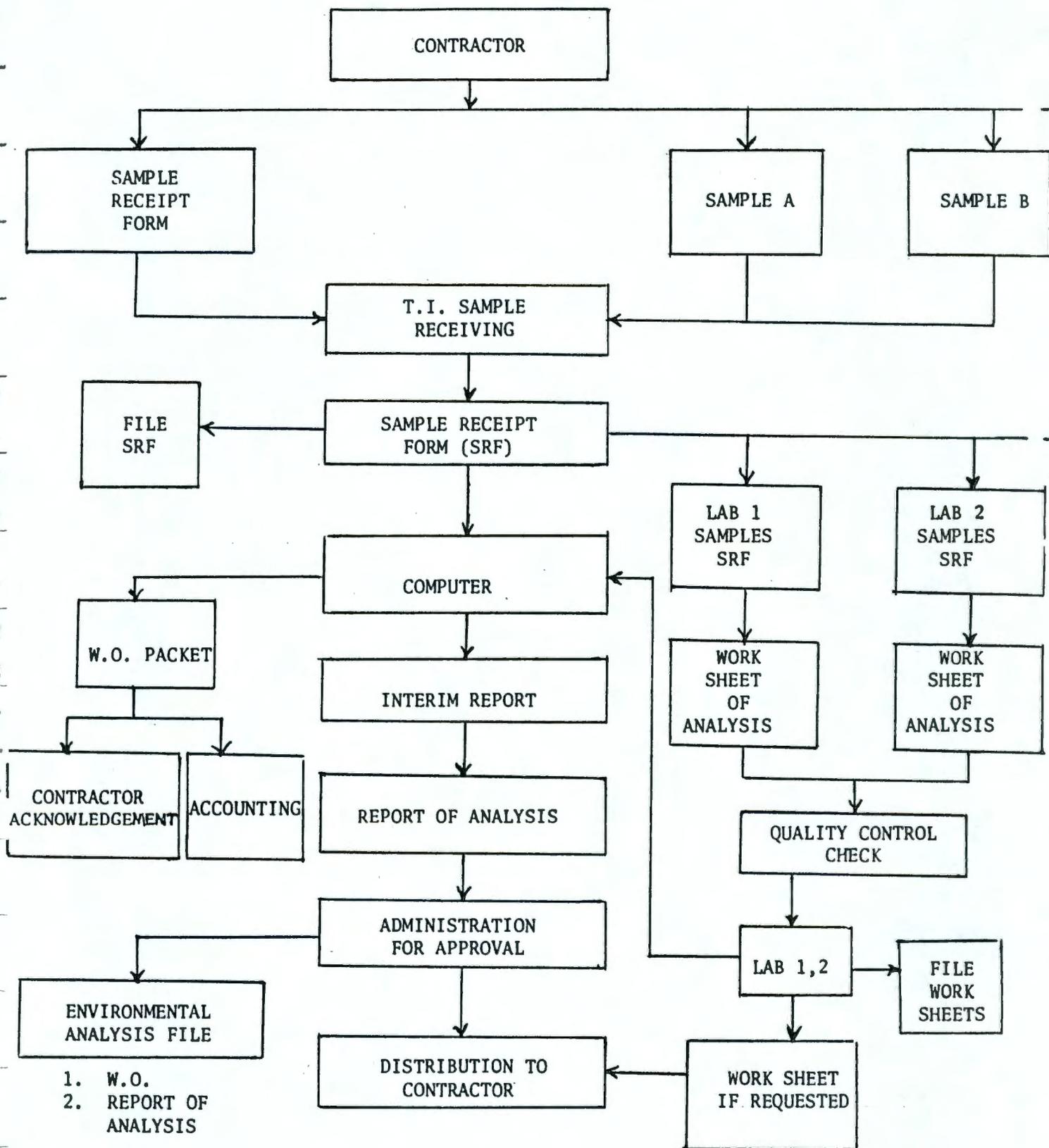
4.2.3 After mounting the sample shall be delivered to the counting area with the completed work sheet. Computation of the activity level shall be

made by a programmed computer. The program shall be available for inspection and shall be documented. The program shall be verified prior to being put into use and after each modification. The verification process shall include verification by a knowledgeable individual, of the algorithm used and test runs in which the output of the computer computation for a given input can be compared to the "true" values that are known or determined independently of the computer calculation. Documentation of the program shall include a description of the algorithm. The computations shall be checked and signed by a person other than the individual who developed the computer program.

4.2.4 Samples which require a check for purity shall be recounted after approximately one half-life of the isotope being monitored. A copy of the work sheet to be used for various analyses is attached. Copies of work sheets shall be sent to contractor if required. Originals shall be kept on file permanently. These records shall be kept under the supervision of the manager of the laboratory or a qualified designate.

Figure 2

FLOW CHART FOR TELEDYNE ISOTOPES SAMPLES



TELEDYNE ISOTOPES

NOTE: Customer is to Fill In Only the Shaded Areas.

SAMPLE RECEIPT FORM

FORM IWL-1

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|----------------------------------|--------------|-------------------------------|----------------------|---------------|---|---|--|--|--|----------------|--|--|--|--|--|--|--|--|--|---|--|----|----|------------|----|---------------|----|------------------|----|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------------|----|----|----|----|----|----|----|----|----|
| SPECIAL INSTRUCTIONS: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | PAGE | OF | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | DESCRIBE OTHER ANALYSIS | | | | | | | | | |
| REC. NO. | DATE RECEIVED | CUSTOMER NO. | PWO NO. | SHIP TO CUSTOMER NO. | DELIVERY DATE | X | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAMPLE RECEIPT NO. | E - ENVIRONMENTAL / P - IN PLANT | | | | | | | | | | | | | | | | | | | | C - Cu. Centimeters M - Cu. Meters T - Sq. Meters | | | | | | | | | | SAMPLE TYPE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | CUSTOMER - TITLE | | | | | | | | | | | | | | | | | | | | F - Cu. Feet S - Sq. Feet U - Sq. Centimeters | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | COLLECTION PERIOD | | | | | | | | | | VOLUME OR AREA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | SAMPLE NO. | | STATION NO. | | OTHER ANAL. CODE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | FOR TI USE | | Min. 2 Digits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | SAMPLES - DESCRIBE - IDENTIFY | | | | | | | | | | | | | | | | | | | | 23 | 24 | 25 | 26 | 27 | 28 | | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 |

4.5

| | | | | | | | |
|-------------------|---|--|--------------------------------------|--------------------------------------|------------------------------------|--------------------------------------|-------------------------------|
| SHIPPED _____ | VIA: <input type="checkbox"/> AIR FREIGHT | <input type="checkbox"/> REPORTING | <input type="checkbox"/> RADCHEM (3) | <input type="checkbox"/> LOG BOOK | | | |
| RECEIVED _____ | <input type="checkbox"/> AIR MAIL | <input type="checkbox"/> ADMIN | <input type="checkbox"/> Ge (Li) (2) | <input type="checkbox"/> | COMP.: | Frequency | Area |
| DISTRIBUTED _____ | <input type="checkbox"/> PARCEL POST | <input type="checkbox"/> SAMPLE RECEIPT-FILE | <input type="checkbox"/> GAS (2) | <input type="checkbox"/> INPLANT (2) | <input type="checkbox"/> MONTHLY | <input type="checkbox"/> EA. STATION | <input type="checkbox"/> ZONE |
| | <input type="checkbox"/> OTHER | <input type="checkbox"/> TRITIUM | | | <input type="checkbox"/> QUARTERLY | | |

Analysis

Et. Ca. IWL-1

Ge (Li) Rev. 05/75

H3

S-89-90

9 | 1 | 2 | 2 | 4 | 1 | 0 | 3 | 0 |

RADIOCHEMICAL WORK SHEET

| SAMPLE NUMBER | | | | |
|---------------|--|--|--|--|
| | | | | |

| NUCLIDE | | | | | |
|---------|--|--|--|--|--|
| | | | | | |

CUSTOMER _____ COLLECTION DATE _____

MOUNTING DATE _____ SAMPLE TYPE _____

VOLUME _____ UNITS _____ ALIQUOT _____

SCAVENGE DATE _____ TIME _____

YIELD _____ NUCLIDE _____ ASH WT. _____ gms

MILKING DATE _____ TIME _____

YIELD _____ NUCLIDE _____ WET WT. _____ gms

ANALYST _____ INGROWTH FACTOR _____

DECAY FACTOR _____ ASH WT. (100) = _____ %
(MILK TO COUNT) WET WT.

| COUNTING | | COUNTER | N (Counts) | Δt (min) | $\frac{N}{\Delta t}$ (cpm) | Bkg. (cpm) | A (cpm) | E (eff.) | |
|----------|------|---------|---------------|-------------|-------------------------------|---------------|------------|-------------|--|
| Date | Time | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

| Decay Factor | INTERVAL | |
|-----------------|-------------|----------|
| | Colln to Ct | Ct to Ct |
| | | |
| | | |
| | | |
| | | |

| ACTIVITY OR MDL | | | | | | | | | | |
|-----------------|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | | |

UNITS _____ CALC. BY _____ DATE _____

ENTERED _____ CHECKED BY _____ DATE _____

4.6

CALCULATION SHEET - RA-226 GAS COUNTING

CUSTOMER NAME _____ T.I. NO.

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

LAB CODE NO. 022 FLASK NO. _____

DETECTOR NO. _____ SCAVANGE DATE _____ @ _____

DETECTOR EFF. _____ FILL DATE _____ @ _____

DETECTOR BKGD. _____ ± _____ SAMPLE SIZE _____

ELECTRONICS NO. _____ MEASURED BY _____

BACKGROUND COUNTS _____ BACKGROUND COUNT TIME (MIN) _____

COUNTING DATA

| Initial | Start Time | Δt | Alpha Channel | α cpm |
|---------|------------|----|---------------|-------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

COUNT VOLTAGE _____

$$\text{Ra226 Activity} = \frac{N}{(\bar{\Delta} - \text{bkg}) (e^{+\lambda T_2}) (0.45)} \frac{1}{(\text{EFF})(1 - e^{-\lambda T_1})(\text{Sample Size})}$$

CALCULATION DATA:

Rn222 Ingrowth _____ (1-e^{-λT1})

Rn222 Decay _____ (e^{+λT2})

Ra226 Activity _____ ± _____

Secondary Result _____ ± _____

Mid Count Time _____ @ _____

CALCULATED BY _____ DATE _____

APPROVED BY _____ DATE _____

05/07/85
IWL-5

91122133101821

RADIOASSAY AND CALCULATION SHEET

Lab. Code No. _____ Nuclide _____
 Detector No. _____ Detector Eff. _____
 Fill System No. _____ Fill: _____ MM
 Fill System Volume: _____ MM
 Corr. Factor _____ Press. _____ MM at _____ °C
 Elect. No. _____
 Date _____ Mano. Rest. _____

COUNTING DATA

| Start Time | Δt | Gross | Beta Channel | Gross | Net β |
|------------|----|-------|--------------|-------|-------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Vol. Analy. _____ ℓ Carrier Vol. _____ cc
 Total in Detector _____ cc Equiv. Vol. _____ ℓ 5/4 x 1
 β cpm _____ ± _____
 - BKG cpm _____ ± _____
 Net cpm _____ ± _____
 Carrier Content _____ ± _____ Carrier dpm _____ ± _____

$$\frac{N}{\Delta t} - \text{BKG} - \left(\frac{\text{VOL CARR}}{\text{RECOV CC}} \right) \left(\frac{\text{ACT CARR}}{\text{CPM}} \right) =$$

(2.22) (YIELD) (VOL SAMPLE) (EFF) (DECAY F)

Lab. Code No. _____

Nuclide(s) _____

Date _____

Sample Vol. _____

MM

System No. _____

MM

System Vol. _____

Press _____ at _____ °C

Corr. Factor _____

Mano. Rest. _____

_____ Spike

MM

System No. _____

MM

System Vol. _____

Press _____ at _____ °C

Corr. Factor _____

Mano. Rest. _____

_____ Spike

MM

System No. _____

MM

System Vol. _____

Press _____ at _____ °C

Corr. Factor _____

Mano. Rest. _____

RESIDUAL PRESSURE

Upper Reading _____ MM

Lower Reading _____ MM

Press _____ MM X

Starting Vol. _____

Final Vol. _____

Remaining Vol. _____

APPROVED BY _____

91122318841

LAB DATA INPUT SHEET

| COMPANY: | | DATA ENTERED BY: | | DATE: | | APPROVED BY: | | DATE: | | GAS ANALYSIS ONLY | ANALYSIS | | | | | | | | | | SAMPLE TYPE | NUCLIDE UNITS % | ASH WEIGHT % | CARD CODE | | | | | | |
|----------|---------------|------------------|----------------|-------|----|--------------|-------|----------|----------------|-------------------|----------|--------------|-------------|--------------|----------------|----------|-----------|--------------|--------------|-------------|------------------|-----------------|--------------|----------------|-----------------|-----------------|--------------|-----------|--|--|
| LAB NO. | SAMPLE NUMBER | NUCLIDE | MID-COUNT TIME | | | | UNITS | ACTIVITY | CATALOG NUMBER | GR ALPHA | GR BETA | GR ALPHA S+D | GR BETA S+D | GR BETA -K40 | H3 (LIQ SCINT) | H3 (GAS) | CARBON 14 | STRONTIUM 90 | STRONTIUM 90 | I 131 (GAL) | I 131 (RAD CHEM) | RA 226 | ELEM CA | GAMMA SPEC GAL | OTHER ANAL CODE | NUCLIDE UNITS % | ASH WEIGHT % | CARD CODE | | |
| | | | MM | DD | HH | MM | | | | | | | | | | | | | | | | | | | | | | | | |
| 042 | | RE-7 | / | | | | E | | | | | | | | | | | | | | | | | | | | | | | |
| | | K-40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CR-51 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | MN-54 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CO-58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | FE-59 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CO-60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ZN-65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ZK-95 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | RU-103 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | RU-106 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | I-131 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CS-134 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CS-137 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | BA-140 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CE-141 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | CE-144 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | RA-226 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TH-228 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

4.11

9, 1, 1, 2, 2, 1, 9, 3, 6

LAB DATA INPUT SHEET

| COMPANY: | | DATE: | | APPROVED BY: | | DATE: | |
|------------------|---------------|------------------------------------|----------------|---------------------------------------|----------|-------------------|----------|
| DATA ENTERED BY: | | DATE: | | APPROVED BY: | | DATE: | |
| LAB NO. | SAMPLE NUMBER | NUCLIDE | MID-COUNT TIME | UNITS | ACTIVITY | GAS ANALYSIS ONLY | |
| | | | | | | CATALOG NUMBER | ANALYSIS |
| 1213 | 95011213 | 4516171819202122232425262728293031 | MM/DD HH:MM | B335058375059404142434445464748495051 | | | |
| | | | | | | GR ALPHA | |
| | | | | | | GR BETA | |
| | | | | | | GR ALPHA S+D | |
| | | | | | | GR BETA S+D | |
| | | | | | | GR BETA - K40 | |
| | | | | | | H3 (LIQ SCINT) | |
| | | | | | | H3 (GAS) | |
| | | | | | | CARBON 14 | |
| | | | | | | STRONTIUM 89 | |
| | | | | | | STRONTIUM 90 | |
| | | | | | | I 131 (G/L) | |
| | | | | | | I 131 (RADCHEM) | |
| | | | | | | RA 226 | |
| | | | | | | ELEM CA | |
| | | | | | | GAMMA SPEC G/L | |
| | | | | | | OTHER ANAL CODE | |
| | | | | | | SAMPLE TYPE | |
| | | | | | | NUCLIDE UNITS % | |
| | | | | | | ASH WEIGHT % | |
| | | | | | | CARD CODE | |

DATA SHEET
K-40 IN AQUEOUS SOLUTIONS
BY FLAME PHOTOMETRY

CALIBRATION LINE DATA:

| STANDARD CONC (PPM) | PHOTOMETER READING |
|------------------------|-----------------------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

SAMPLE DATA:

C E A ± 10%

| SAMPLE NUMBER | TYPE | PHOTOMETER READING | INTERPOLATED CONC (PPM) | CONC FACTOR (final vol/initial) | K-40 pCi/l A = 0.83 CE |
|------------------|------|-----------------------|----------------------------|------------------------------------|---------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Analyst _____ Units _____ Calc By _____ Date _____
 Date _____ Entered _____ Checked by _____ Date _____

C. er _____
 Disk _____

9 11 1012. 2011 19 21
 AND LIQUID SCINTILLATION

Cus or _____
 Analyst _____

| TI No. | Type | Mid Count | N | Δt min | V LS ml | Bkg. cpm | Eff. | Enrichment | Result |
|--------|------|----------------|---|-------------------|------------|-------------|------|---|--------|
| | | Cell No. _____ | | | | | | V+ _____ g _____ g V _f _____ g V _o _____ g | |
| | | Cell No. _____ | | | | | | V+ _____ g _____ g V _f _____ g V _o _____ g | |
| | | Cell No. _____ | | | | | | V+ _____ g _____ g V _f _____ g V _o _____ g | |
| | | Cell No. _____ | | | | | | V+ _____ g _____ g V _f _____ g V _o _____ g | |

4.18

Result Units _____

Calc. by _____

Date: _____

Code _____

Checked by _____

Date _____

Disk _____

Customer _____

Analyst _____

TRITIUM BY GAS COUNTING

TI No. _____

Station _____

Collection Date _____

Sample Converted _____ ml

Conversion Date _____

Conversion System _____

| H.V. | Δt | BC | AC | BC/ Δt | AC/ Δt | δ | GC | GC/ Δt |
|------|------------|----|----|----------------|----------------|----------|----|----------------|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Sample Type _____

Mid Count (MM/DD HHMM) _____

Sample Pressure (PSIA) _____

Efficiency Prop. Factor _____ x10³

Sample Counts _____

Sample Count Time (min) _____

Background Counts _____

Background Count Time (min) _____

Enrichment:

| | | |
|---------|-------|---|
| V \pm | _____ | g |
| _____ | _____ | g |
| Vf | _____ | g |
| Vo | _____ | g |

Cell No. _____

Primary Result _____

Units _____

Secondary Result _____

Code _____

Efficiency _____

Calc by _____

Date _____

Checked by _____

Date _____

911223318(94)

ALPHA SPECTROSCOPY DATA

Th-229 _____ ml U-232 _____ ml CUSTOMER _____
 Am-243 _____ ml Cm-243 _____ ml ANALYST _____
 Pu-236 _____ ml Pu-240 _____ ml

TI NO _____ SAMPLE TYPE _____ ALIQUOT _____

| NUCLIDE | Mid Count MM/DD HHMM | Counts | #t, sec | Spike Counts | Spike Activity, pCi | Bkg Counts | Bkg #t, sec | Results |
|---------|-------------------------|--------|---------|-----------------|------------------------|---------------|----------------|---------|
| Pu-239 | | | | | | | | |
| Pu-238 | + | | + | + | + | | + | |
| U-238 | | | | | | | | |
| U-235 | + | | + | + | + | | + | |
| U-234 | + | | + | + | + | | + | |
| U-236 | + | | + | + | + | | + | |
| Am-243 | | | | | | | | |
| Am-241 | | | | | | | | |
| Cm-244 | | | | | | | | |
| Cm-242 | | | | | | | | |
| Cm-246 | | | | | | | | |
| Th-232 | | | | | | | | |
| Th-230 | + | | + | + | + | | + | |
| Th-229 | + | Spike | + | + | + | | + | |
| Th-228 | + | | + | + | + | | + | |

4.23

Result Units _____

Ash fraction _____

Calc. by _____

Date _____

Code _____

Checked by _____

Date _____

TELEDYNE ISOTOPES

50 VAN BUREN AVE. • WESTWOOD, N.J. 07675-0306 • PHONE (201) 864-7070 • TELEX: 134-474 • EASYLINK: 62677198

09/17/86
DATE

SHIP TO
MS S A COY
DUKE POWER CO
COCNEE NUCLEAR STATION
P O BOX 1439
SENECA SC

25678

BILL TO
DUKE POWER COMPANY
MILL POWER SUPPLY CO
P O BOX 32307
CHARLOTTE NC 28232-2307

| | |
|---------------------|------------------|
| WO NO 3-2894 | C CODE DU501N |
| P.W.O. NO 3-8651 | REL 018 |

| | | | | | | | | | | | |
|---|------------------|-----|-----------|----|-----|------------|--------|------------|---------|----------------------------|--|
| CUSTOMER ORDER NUMBER P12515-7H B58893 | DATE 09/12/86 | FOB | TC 33N | SV | REP | COMMISSION | REP | COMMISSION | CERT | TASK SUPERVISOR H. KING | TERMS: NET 30 DAYS. SUBJECT TO 1% FINANCE CHARGE PER MONTH OVER 30 DAYS. |
| SHIPPED VIA | | | | | | DATE | WEIGHT | NO PKGS. | CHARGES | PARTIAL | |

4.25

| ITEM | QTY. ORDER | QTY. SHIP. | CATALOG NUMBER | DELIVERY DATE | DESCRIPTION | UNIT PRICE | TOTAL |
|------|------------|------------|----------------|---------------|---|------------|--------|
| 1 | 1 | | U-0302-032 | 10/15/86 | RAD CHEM ANALYSIS | | |
| | 1 | | U-0302-032 | 10/15/86 | RAD CHEM-AP FILTERS FOR SR-89 | | |
| | 1 | | U-0302-032 | 10/15/86 | UNIT 1 VENT FILTERS 08/01-08/31 TI NO.-76822 | .00 | |
| 2 | 1 | | U-0303-032 | 10/15/86 | UNIT 2 VENT FILTERS 08/01-08/31 TI NO.-76823 | .00 | |
| | 1 | | U-0303-032 | 10/15/86 | UNIT 3 VENT FILTERS 08/01-08/31 TI NO.-76824 | .00 | |
| | 1 | | U-0303-032 | 10/15/86 | RAD CHEM-AP FILTERS FOR SR-90 | | |
| 3 | 1 | | U-0305-032 | 10/15/86 | UNIT 1 VENT FILTERS 08/01-08/31 TI NO.-76822 | 68.25 | |
| | 1 | | U-0305-032 | 10/15/86 | UNIT 2 VENT FILTERS 08/01-08/31 TI NO.-76823 | 68.25 | |
| | 1 | | U-0305-032 | 10/15/86 | UNIT 3 VENT FILTERS 08/01-08/31 TI NO.-76824 | 68.25 | |
| 4 | 1 | | U-0307-032 | 10/15/86 | RAD CHEM-AP FILTERS FOR GROSS ALPHA ONLY | | |
| | 1 | | U-0307-032 | 10/15/86 | UNIT 1 VENT FILTERS 08/01-08/31 TI NO.-76822 | 15.75 | |
| | 1 | | U-0307-032 | 10/15/86 | UNIT 2 VENT FILTERS 08/01-08/31 TI NO.-76823 | 15.75 | |
| 5 | 1 | | U-0309-032 | 10/15/86 | UNIT 3 VENT FILTERS 08/01-08/31 TI NO.-76824 | 15.75 | |
| | 1 | | U-1604-032 | 10/15/86 | RAD CHEM-LIQUID RADWASTE FOR SR-89 | | |
| | 1 | | U-1604-032 | 10/15/86 | CMT/LHST COMPOSITE 08/01-08/31 TI NO.-76820 | .00 | |
| 6 | 1 | | U-1605-032 | 10/15/86 | CTP 3 COMPOSITE 08/01-08/31 TI NO.-76821 | .00 | |
| | 1 | | U-1605-032 | 10/15/86 | RAD CHEM-LIQUID RADWASTE FOR SR-90 | | |
| | 1 | | U-1605-032 | 10/15/86 | CMT/LHST COMPOSITE 08/01-08/31 TI NO.-76820 | 68.25 | |
| 7 | 1 | | U-1609-032 | 10/15/86 | CTP 3 COMPOSITE 08/01-08/31 TI NO.-76821 | 68.25 | |
| | 1 | | U-1609-032 | 10/15/86 | RAD CHEM-LIQUID RADWASTE FOR GROSS ALPHA ONLY | | |
| | 1 | | U-1609-032 | 10/15/86 | CMT/LHST COMPOSITE 08/01-08/31 TI NO.-76820 | 21.00 | |
| 7 | 1 | | U-1613-032 | 10/15/86 | CTP 3 COMPOSITE 06/01-08/31 TI NO.-76821 | 21.00 | |
| | 1 | | U-1613-032 | 10/15/86 | RAD CHEM-LIQUID RADWASTE FOR FE-55 | | |
| | | | | | CMT/LHST COMPOSITE 08/01-08/31 TI NO.-76820 | 78.75 | |
| | | | | | CTP 3 COMPOSITE 08/01-08/31 TI NO.-76821 | 78.75 | |
| | | | | | | | 588.00 |

SPECIAL INSTRUCTIONS:

TOTAL ORDER VALUE

AUTHORIZED SIGNATURE:

TELEDYNE ISOTOPES

INTERIM REPORT OF ANALYSIS

RUN DATE 09/08/86

| | | | | | | |
|---|-------|-----------------------------|--|---------------------------|---------------------------|-----------|
| DR CARY G. BAKER RADIOLOGIC PRCG MGR THREE MILE ISLAND NUCLEAR STA GPU NUCLEAR CORP 2574 INTERSTATE DRIVE HARRISBURG PA | 17110 | WORK ORDER NUMBER 3-2679 | CUSTOMER P.O. NUMBER TC-022754 LI-1 | DATE RECEIVED 09/02/86 | DELIVERY DATE 10/03/86 | PAGE 1 |
|---|-------|-----------------------------|--|---------------------------|---------------------------|-----------|

WATER - DRINKING

4.26

| TELEDYNE SAMPLE NUMBER | CUSTOMER'S IDENTIFICATION | STA NUM | COLLECTION-DATE | | NUCLIOE | ACTIVITY (PCI/LITER) | NUCL-UNIT-1 U/M * | MID-COUNT TIME | | VOLUME - UNITS ASH-WGHT-(* | FLAG |
|------------------------------|------------------------------|------------|-----------------|--------------|---|--------------------------|----------------------|-------------------|------|--------------------------------|------|
| | | | START DATE | STOP DATE | | | | DATE | TIME | | |
| 75602 | 02301032 | G153 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75602 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75602 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75603 | 02301032 | G151 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75603 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75603 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75604 | 02301032 | G151 | 08/07 | 08/29 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75604 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75604 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75605 | 02301032 | G152 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75605 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75605 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75606 | 02301032 | J152 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75606 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75606 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75607 | 02301032 | H5 2 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75607 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75607 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |
| 75608 | 02301032 | H5 2 | 07/31 | 08/28 | RAD CHEM-DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75608 | 05111032 | | | | RAD CHEM/SR - DRINKING WATER FOR GROSS BETA | | | | | | 0000 |
| 75608 | 00045042 | | | | GAMMA SPEC.-GE(LI) - DRINKING WATER | | | | | | 0000 |

9 1 1 2 2 1 1 3 0 1 1

RECEIVED APR 04 1986

TELEDYNE ISOTOPES
REPORT OF ANALYSIS

RUN DATE 04/04/86

| | | | | | |
|--|-----------------------------|----------------------------------|---------------------------|---------------------------|--------|
| MR J W MCINTIRE DUQUESNE LIGHT COMPANY BEAVER VALLEY POWER STATION P O BOX 4 SHIPPINGPORT PA | WORK ORDER NUMBER 3-6127 | CUSTOMER P.O. NUMBER D 011647 | DATE RECEIVED 03/05/86 | DELIVERY DATE 04/04/86 | PAGE 1 |
| 15077 | | | | | |

AIR PARTICULATE FILTERS

| TELEDYNE SAMPLE NUMBER | CUSTOMER'S IDENTIFICATION | STA NUM | COLLECTION-DATE | | | NUCLIDE | ACTIVITY (PCI/QU. M) | NUCL-UNIT-(U/M * | MID-COUNT TIME | | VOLUME - UNITS ASH-WGHT-(* LAB. |
|------------------------------|------------------------------|------------|-----------------|------|--------------|---------|--------------------------|----------------------|-------------------|-------|--|
| | | | START DATE | TIME | STOP DATE | | | | TIME | DATE | |
| 56908 | MEYER FARM | 13 | 02/24 | 1315 | 03/03 | 1141 | GR-B | 1.6 +-0.4 | E-02 | 03/11 | 9.16E 03 CU.FT 3 |
| 56909 | BRUNTON DAIRY FARM | 27 | 02/24 | 1526 | 03/03 | 1332 | GR-B | 1.6 +-0.4 | E-02 | 03/11 | 1.06E 04 CU.FT 3 |
| 56910 | SHERMAN DAIRY FARM | 28 | 02/24 | 1048 | 03/03 | 0914 | GR-B | 1.5 +-0.4 | E-02 | 03/11 | 1.08E 04 CU.FT 3 |
| 56911 | BEAVER CD HOSPITAL | 29B | 02/24 | 1013 | 03/03 | 0843 | GR-B | 1.6 +-0.4 | E-02 | 03/11 | 1.05E 04 CU.FT 3 |
| 56912 | SHIPPINGPORT | 30 | 02/24 | 1242 | 03/03 | 1102 | GR-B | 1.8 +-0.4 | E-02 | 03/11 | 1.08E 04 CU.FT 3 |
| 56913 | MIDLAND | 32 | 02/24 | 1155 | 03/03 | 1020 | GR-B | 2.0 +-0.4 | E-02 | 03/11 | 1.04E 04 CU.FT 3 |
| 56914 | INDUSTRY | 46 | 02/24 | 1216 | 03/03 | 1041 | GR-B | 1.3 +-0.4 | E-02 | 03/11 | 1.04E 04 CU.FT 3 |
| 56915 | EAST LIVERPOOL | 47 | 02/24 | 1127 | 03/03 | 0950 | GR-P | 1.6 +-0.4 | E-02 | 03/11 | 1.02E 04 CU.FT 3 |
| 56916 | WEIRTON | 48 | 02/24 | 1439 | 03/03 | 1248 | GR-B | 1.1 +-0.3 | E-02 | 03/11 | 1.06E 04 CU.FT 3 |
| 56917 | ALTOQUIPPA | 51 | 02/24 | 1617 | 03/03 | 1357 | GR-R | 1.4 +-0.4 | E-02 | 03/11 | 1.07E 04 CU.FT 3 |

4.27

SECTION 5.0 ACCEPTANCE OF RESULTS OF ANALYSES
AND CORRECTIVE ACTION

All results shall be checked to assure they meet the requirements as specified in the procedures and that all calculations are correct and reasonable. Corrective action is to be instituted if the above conditions are not met.

5.1 Acceptance of Sample Results

5.1.1 Before approval of a work sheet by the Quality Assurance Manager or a qualified designate, any results which are suspect, being higher or lower than results in the past, shall be recalculated. At least five percent of results shall be recalculated routinely by a person other than the person doing the original calculation. A list of the identification (sample No.) of the samples which have been recalculated is recorded by the person who approves the data sheet on form IWL-45 attached. An identifying mark is placed on the work sheet by the person doing the recalculation and those results which have been recalculated can be retrieved from the file. 10/87

5.1.2 The yields of the analytes being monitored shall be within the limits as specified in the procedure being used. All parameters (background, efficiency, decay) shall be checked for reasonableness.

5.1.3 After approval of results by the quality control manager or a qualified designate, data shall be entered into the computer. The counting room shall edit any results which have not been approved from the computer disc before entering results into the main computer. The printout of results shall be edited also and initialed to maintain a record of the completed computations.

5.2 Acceptance of Results of Gamma Spectrometer Measurements

5.2.1 For gamma spectrometer results entered on a computer data entry sheet, the sheet shall be initialed by the technician who enters the data and a supervisor or qualified designate.

10/87

5.2.2 For data that is entered directly into the main computer from tape, a printout shall be examined for errors and initialed by a qualified technician before being entered.

5.3 Corrective Action

5.3.1 If results are not approved by the designated quality control manager, the sample shall be returned to the laboratory for recount. If a longer count, decay check, recount on another system or recalculation does not give acceptable results based on experience and knowledge of equipment capability, a new aliquot with same sample number shall be analyzed if available. Otherwise the sample shall be entered as not analyzed and an explanation shall be appended to the report to the contractor.

5.3.2 When all required data has been entered a completed report is printed by the computer. The completed report shall be examined for errors and signed by the Quality Assurance Manager and/or the Technical Vice President or a qualified designate before being mailed to the customer for billing.

5.3.3 Any revision of the report containing the final data shall be signed by the Quality Assurance Manager and/or Technical Vice President or a qualified designate before being mailed to the customer. The modified results shall be kept on file with the original report.

SECTION 6.0 INSPECTIONS AND REVIEWS

Purpose: To describe the requirements for the inspection and verification for the quality of results.

6.1 Quality Control Reviews

Quality Control checks are to be performed as follows in order to insure the validity of results, compliance with the program of the customer and for adherence to the quality assurance/control requirements.

6.1.1 Check of Sample Receipt Form for completeness and conformance with the program of the customer by supervisor or qualified designate.

6.1.2 Preparation of all composites required by customer and designation of analyses by supervisor or qualified designate.

6.1.3 Monthly inspection of notebooks of technicians for completeness and any errors in computing yields, etc. by supervisor or qualified designate.

6.1.4 Review of all work sheets by the quality assurance manager or a qualified designate.

6.1.5 Editing of discs to remove all unapproved data before entry into computer.

6.1.6 Inspection of all final reports by quality assurance manager and/^{10/87} or technical vice president or qualified designates before being signed and mailed to the customer.

6.2 Qualifications of Reviewer

Inspections are to be performed by individuals other than those who performed the activity being reviewed. The reviewer shall possess adequate knowledge and experience in the procedures, processes and activities of the

technical area to be reviewed. The reviewer shall indicate acceptance by signing or initialing and dating the document reviewed.

SECTION 7.0 RETENTION OF RECORDS

Sufficient records shall be retained to support and rectify the activities relating to quality.

7.1 Quality Assurance Records

Statement of company policy and analytical and quality related documents shall be retained until superceded. Superceded documents shall be retained for a period of five years unless a longer period is required by the customer. These records include originals of analytical procedures, originals of quality assurance and quality control manuals, records of EPA Cross-Check Results and audit reports. These records shall be kept under the control of the quality assurance manager.

7.2 Analytical Results Data

Analytical work sheets documenting analyses and calculation of results shall be retained permanently. Other records such as notebooks of technicians, background and control charts of equipment, calculations of efficiency shall be retained for a period of five years. Maintenance manuals shall be retained for the life of the equipment. These records may be placed in storage after a two-year period. These records shall be retained under the supervision of the department doing the analysis. 10/87

7.3 Radiological Environmental Monitoring Program Reports

All records such as REMP Reports (Radiological Environmental Monitoring Program Reports) shall be kept on file for three years or as long as required by the customer. These records may be placed in storage after a period of three years. They shall be retained under the supervision of the

administrative office of the technical vice president.

7.4 All records shall be stored so as to prevent damage and deterioration and to provide for ease of retrieval.

SECTION 8.0 CONTROL OF PREPARATION, REVISION
AND DISTRIBUTION OF PROCEDURES AND MANUALS

The purpose of control of preparation, revision and distribution of procedures and manuals is to insure the use of written and approved procedures and manuals prepared in accordance with proven analytical practice. Documentation of issuance, revision and distribution is provided for.

8.1 Procedure Preparation

8.1.1 A copy of the applicable, approved procedure shall be provided in the laboratory where the analysis is performed.

8.1.2 Written procedures shall be prepared by the laboratory manager or a designate, and approved by the laboratory manager. They shall be approved by the technical vice president and the quality assurance manager before being put into general use. The procedures shall be evaluated and updated by the laboratory manager as experience and new information warrant.

8.1.3 Periodic checks by supervisory personnel shall be made to see that written procedures and good laboratory practice are being followed.

8.2 Procedure Control and Distribution

8.2.1 Changes in procedures shall be listed at the bottom of the first page of the procedure including the number of the revision, the number of pages in the revision, the signature of the person preparing the procedure or revision, the date of preparation, and effective date. If a revision involves only part of a procedure, the person preparing the revision shall list only the paragraphs for which he or she is responsible. All changes in procedures shall be approved by the technical vice president and the quality assurance manager.

8.2.2 When a procedure is changed, the revised sentences, paragraphs or equations are indicated by a vertical line. The date of the revision is typed adjacent to the line.

8.2.3 Minor changes in procedures which involve semantics or errors in spelling may be changed by inking in the correction. Changes which involve the chemistry or counting methods of a procedure may be inked in and instituted only with the approval of the department manager which shall be indicated by his initials on the corrected copy of the procedure. These changes shall be followed by a reissue of the procedure as soon as practicable.

8.2.4 All existing copies shall be kept up to date and listed on the distribution control form IWL-22R in the manager's office with the date of the latest issue. A copy of form IWL-22R is attached. The signature of the person receiving the procedure shall be obtained on the distribution form as specified in PRO-032-60. Out-of-date copies shall be marked obsolete or destroyed. Copies for distribution outside of the company shall be marked controlled if an updated copy is required.

8.2.5 If it is required by a change in a procedure, the department manager shall instruct the laboratory supervisor to retrain personnel involved to assure that they are aware of and understand the new requirements.

8.3 Manual Preparation, Control and Distribution

8.3.1 Copies of all applicable Quality Assurance and Quality Control Manuals shall be supplied to the laboratory supervisors and department managers concerned. Personnel in their department shall be acquainted with the goals and purposes of the Quality Assurance Program.

8.3.2 Quality Assurance and Quality Control Manuals shall be prepared

and updated as new information requires by the Quality Assurance Manager and/or the department manager. They shall be reviewed and revised if necessary at least once every three years. This shall be documented on form IWL-23R at the front of the manual. If no changes are made, it is not necessary to redistribute the manual. Only the original and copy of the quality assurance manager will contain the review, the date of the review and a statement that no changes were made. Reissues of manuals shall be listed on form IWL-23R at the front of each manual, including the list of pages changed, person making the changes, date of changes and approvals. A copy of form IWL-23R is attached.

8.3.3 Copies of revised manuals shall be distributed to all departments and customers listed on form IWL-22R or on an appropriate tabulation including the copy number of the manual distributed. Only those specified as controlled copies shall be updated. Uncontrolled copies are sent for information only and are not reissued.



DOCUMENT ISSUE AND REVISION CONTROL FORM

DOCUMENT: _____

TITLE: _____ T.I. NUMBER: _____

| ISSUE AND REVISIONS | PAGES | PREPARED | | EFFECTIVE DATE | APPROVED BY |
|---------------------------|-------|----------|------|-------------------|----------------|
| | | BY | DATE | | |
| | | | | | |

9 11 1 12 2 04 3 11 9 11 4 1

SECTION 9.0 ANALYSIS OF QUALITY CONTROL SAMPLES

Blank and spiked samples provide a means to determine the precision and accuracy of the monitoring process. Analysis of spiked samples of known concentration and activity provides a means of determining accuracy. Analysis of replicate samples provides a means of determining precision. Analysis of blank samples provides a means to detect contamination and to check adequacy of background subtraction and purity of reagents and chemicals used.

9.1 Blank, Spike and Replicate Samples

9.1.1 Blank, spiked and replicate samples shall be analyzed in each laboratory totaling at least 5% of the analytical sample load. Quality Control samples prepared by contractors may be used in computing this percentage. Spikes shall be prepared from NBS standards or the equivalent. Blank and spiked samples shall be submitted for analysis as unknowns where possible. These blanks and spikes may include blind replicates. 10/87

9.1.2 The results of the spiked and blank samples shall be reported to the quality assurance manager as soon as possible. They shall be kept on file in the office of the quality assurance department. These results shall be analyzed and corrective action taken if necessary. The acceptance criteria depend on the particular analysis and should fall within 3 standard deviations of the EPA one sigma, one determination as specified in the Environmental Radioactive Laboratory Studies Program, EPA-60/4-81-004, Table 3, Page 8.

9.2 EPA Intercomparison Samples

Samples are submitted by the EPA on a nationwide basis to participating laboratories from the Environmental Monitoring Systems Laboratory, Post Office Box 15027, Las Vegas, Nevada, 89114. All samples which are

applicable to the analyses performed at Teledyne Isotopes shall be analyzed and the results submitted to the EPA. The acceptance criteria is \pm three normalized deviations from the known. The method of calculating the normalized deviation is described in EPA-600-4-81-004, February 1981, "Environmental Radioactivity Laboratory Intercomparison Studies Program".

The results of the EPA intercomparison tests shall be analyzed by the quality assurance manager. Form IWL-35R, a copy of which is attached, shall be prepared giving the normalized deviation from the known and the grand average of all the participants in the cross-check. This report of results is to be sent to the laboratory manager, the laboratory supervisor and the technician who performed the analysis for their information and any necessary action.

If the results to the EPA cross-check analyses are beyond the \pm two sigma limits as specified in the EPA Report of Results, Form IWL-49, a copy of which is attached, shall be prepared comparing the results with previous tests to indicate whether or not a trend is indicated. Documentation of corrective action shall be included in the reply to the report.

The results of all EPA cross-check analyses shall be documented in Quality Control Manual IWL-0032-361 and a copy sent to all interested customers every six months.

CORRECTIVE ACTION FOR EPA CROSS-CHECK _____

Date _____

QA Contact _____

Analysis _____

Medium _____

| <u>Collection Date</u> | <u>TI NO.</u> | <u>EPA Results</u> | <u>TI Results</u> | <u>Normalized Deviation</u> |
|------------------------|---------------|--------------------|-------------------|-----------------------------|
|------------------------|---------------|--------------------|-------------------|-----------------------------|

RESULTS OF PREVIOUS CROSS CHECKS

| <u>Collection Date</u> | <u>NO.</u> | <u>EPA Results</u> | <u>TI Results</u> | <u>Normalized Deviation</u> |
|------------------------|------------|--------------------|-------------------|-----------------------------|
|------------------------|------------|--------------------|-------------------|-----------------------------|

REASON FOR DEVIATION

CORRECTIVE ACTION

Please reply to Q.A. Department within 30 days.

Signature

Copy to: _____

911224319101

SECTION 10.0 INSTRUMENT OPERATION CONTROL

The objective of instrument operation control is to provide documentation for the accuracy and repeatability within statistical limits of the measurements of the activities of radioisotopes.

10.1 Measurements Control

10.1.1 Each laboratory responsible for measuring the activity of samples shall check the efficiency calibration of the equipment at least annually. The details of standards prepared for the efficiency calibration of equipment shall be recorded in a log and signed by the preparer. A qualified person other than the one preparing the standard shall check the results of the computations and initial the log. All standards shall be traceable to NBS standards or the equivalent and shall be prepared in the same manner as the unknown samples or a close approximation thereof. New standards for efficiency calibration of equipment shall be prepared at least every three years as required in Procedure PRO-032-27, Calibration and Control of Alpha and Beta Counters.

10.1.2 Each laboratory measuring the activity of samples shall maintain records of routine measurements of check sources and backgrounds. Check sources for determining changes in counting rate or counting efficiency should be of sufficient radiochemical purity to allow correction for decay but need not have an accurately known disintegration rate, i.e., need not be a standard source. A log and control chart of blanks and check sources shall be maintained. Readings shall be taken as often as needed to maintain stability of operation within acceptable limits (See paragraph 10.2.2 and 10.2.3). The records of background and check sources shall be checked and

initialed by a knowledgeable person other than the person keeping the records.

10.1.3 If the routine measurements are outside of acceptable limits, the instrument shall not be used until corrective action is taken. It shall be tagged with tape or a label stating that it is not to be used for the affected analysis. A summary of its condition and date shall be listed on the instrument and/or the log of the instrument. A set of check sources and a background shall be measured after each interruption for repair before the instrument is returned to service.

10.1.4 A recommended criteria for acceptable operation is ± 3 sigma of the standard deviation for the previous month's measurements or for the group of measurements used for constructing the control chart.

10.2 Control of Instrumentation

10.2.1 A maintenance log of each instrument shall be kept in a notebook with all changes and adjustments recorded and the date of the change. This may be included in the background and/or standard notebook where applicable.

10.2.2 For manually loaded counting systems check sources must be counted each week day that equipment is in use (excluding holidays) and after each gas change. Overnight blanks shall be read as often as possible, generally once or twice per week. A 200 minute blank shall be read every week. For systems with automatic sample loaders background measurements and check sources must be included within each measurement cycle. This procedure is described in PRO-032-27.

The alpha counters used to measure Ra-226 are to be calibrated monthly with an NBS traceable standard. Backgrounds shall be taken at least every other day when a counter is in use. This procedure is described in PRO-022-65.

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10.2.3 For alpha and gamma ray spectrometry systems energy calibration checks with a source containing 2 or more rays of known energy shall be made at least weekly and the results recorded to determine the relationship between channel number and alpha or gamma ray energy. Adjustments shall be made where necessary. Energy resolution measurements shall be made and recorded at least monthly and after system changes such as power failures and repairs. Count rate measurements or counting efficiency shall be determined and recorded at least weekly and after system changes such as power failures and repairs. This procedure is described in PRO-042-44.

10.3 Corrective Action

The counting room technician shall review the routine background and control chart measurements. The laboratory manager shall be informed whenever measurements indicate a counter is out-of-control. Efficiency measurements shall be reviewed periodically (at least yearly) or as indicated by a significant change in the measuring system. All samples counted in counters adjudged to be out-of-control shall be recounted. The method of determining when a counter is out of control and the action to be taken is described in the procedure for calibrating and operating the various types of counting equipment used. See paragraph 10.2.2 and 10.2.3.

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10.4 Analytical Balances

10.4.1 Analytical balances shall be labeled with the manufacturer's serial number. Balances are serviced and cleaned annually by the manufacturer or a qualified representative to meet original specifications. A set of calibrated weights are recertified to NBS class M weight by manufacturer or a qualified representative.

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10.4.2 A certificate of service and calibration shall be issued and each unit shall be labeled and dated with the last service and calibration period. The balance shall be rezeroed and tested with a certified weight each week day that the balance is in use (excluding holidays) and the results shall be recorded in a log. The analyst will rezero the balance before weighing a set of samples. If the balance is not functioning correctly, it shall be removed from use. The balance must be serviced and recalibrated before it is put back in use. The expected precision is ± 0.0005 grams at 1.0000 grams or one sigma equal to ± 0.05 percent. 10/87

SECTION 11.0 AUDITS

Comprehensive, planned and periodic audits shall be made to verify implementation of the quality assurance program. Audit results shall be documented and reviewed by management having responsibility in the area audited. Follow-up action is required to be taken where indicated.

11.1 Internal Audits by the Quality Assurance Department

11.1.1 Comprehensive planned and periodic audits shall be conducted of each laboratory at least annually or as conditions warrant.

11.1.2 An audit shall be conducted in accordance with written procedures or a check list based on the applicable government regulations such as 10 CFR 50, Appendix B, NRC Guide 4.15 and the quality assurance program of Teledyne Isotopes as specified in the quality assurance and quality control manuals. Check List IWL-36A attached may be used or a check list specifically prepared to cover items of particular importance may be substituted where advisable.

11.1.3 The audit shall be conducted by the quality assurance manager or a qualified designate having no direct responsibility in the area audited.

11.2 Audit Review Form and Reply

11.2.1 After the audit, an audit review form IWL-26R or the equivalent shall be completed evaluating the performance of the laboratory and citing any finding adverse to quality. The report shall be sent to the laboratory supervisor with a copy to the laboratory manager. All recommendations require an action reply on form IWL-26R by the laboratory supervisor and/or manager within 30 days of the audit. Any condition which is seriously detrimental to quality shall be reported as a finding on form IWL-63, a copy of which is attached. Corrective action shall be implemented as soon as practicable. Measures taken to prevent a recurrence of the deficiency shall be described.

11.2.2 In order to assure that corrective action is taken in serious matters concerning quality assurance, compliance verification form IWL-20R shall be filled out which requires a monthly follow-up until an adverse condition cited in an audit is corrected. A copy of this form is attached.

11.2.3 The audit check list and the audit review form shall be kept on file in the quality assurance manager's office and be available for inspection on request.

11.2.4 Any deficiencies so adverse to quality as to affect the validity of results obtained shall be immediately reported to top management.

11.2.5 Audit findings and recommendations shall be accepted when the condition cited has been corrected. If a condition cannot be corrected immediately a date must be set on which the condition will be corrected. This is acceptable only if the condition in the judgement of the auditor does not influence the validity of the results. A reaudit is to be conducted until corrective action is satisfactory. Form IWL-62 a copy of which is attached may be used to document follow-up of audit recommendations. A report is to be made to higher management if a corrective action takes an inordinate length of time. The method of verification of the corrective action shall be indicated and any action taken to prevent recurrence of the condition.

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11.3 Training and Qualification of Auditors and Lead Auditors

11.3.1 Auditors

Personnel selected for quality assurance auditing shall be knowledgeable in radiochemistry and monitoring techniques and have experience or training commensurate with the scope, complexity or special nature of the activities to be audited. Competance shall be developed by one or more of the following methods.

11.3.1.1 Orientation to provide a working knowledge and understanding of the Code of Federal Regulations 10 CFR 50, Appendix B, the applicable regulations and the quality program as defined by Teledyne Isotopes.

11.3.1.2 Training to include the objectives, organization and performing of audits including methods of questioning, documenting and closing out of audit findings and recommendations.

11.3.1.3 On-the-job training and guidance by a lead auditor including planning and performing audits and reporting the results.

11.4 Qualification of Lead Auditors

Lead auditors shall be qualified under ANSI N45.2.23, Appendix A or the equivalent which shall include the following requirements.

11.4.1 Education

A degree (associate, bachelor or masters) from an accredited institution preferably in engineering, physical science, mathematics or quality assurance.

11.4.2 Experience

Two or more years experience in chemistry, electronic testing, mathematics, quality assurance or a related field.

11.4.3 Performance Factors

Qualification shall include communication skills, leadership, sound judgement, maturity, analytical ability and courses in quality assurance.

11.4.4 Audit Participation

A lead auditor shall have participated in a minimum of five quality assurance audits within a three year period, one of which shall be a nuclear quality assurance audit.

11.4.5 Examination

A lead auditor shall pass an examination, oral, written or practical to evaluate his/her comprehension and ability to apply the auditing techniques as described in 11.3.1 preceding.

11.4.6 Certification of auditors shall be documented on form from ANSI N45.2.23, Appendix A, a copy of which is attached. A minimum of 10 credits is necessary for certification as a lead auditor.



Audit Check List for Environmental Analysis Department

This check list is used as the guide for the Quality Assurance Audit of the Service or Production Group listed below. The items on this check list are abstracted from 10 CFR 50, Appendix B and NRC Regulatory Guide 4.15. This audit check list supercedes the Compliance Check List (IWL-24) and the Evaluation Check List (IWL-25) used for documentation of audits prior to July 1980.

Service/Production Group: _____

Code No. _____ Supervisor _____

Audit Conducted by _____ Date _____

Signature of Auditor _____ Position _____

Date of Previous Audit _____ Conducted by _____

Audit Review Report Issued on _____ Reply Received on _____

Document Issue and Revision Control Form

| Issue and Revision | Pages | Issued or Revised By | Effective Date | Approved By |
|--------------------|-------|---------------------------|----------------|--|
| Issued | 9 | H. King <i>H. King</i> | 05/83 | J. D. Martin <i>J. David Martin</i> |

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1.0 Organization Structure

- 1.1 Do you understand the Quality Assurance requirements of 10 CFR 50, Appendix B, and of NRC Regulatory Guide 4.15 and are copies available for your use? ___ ___ ___
- 1.2 Are you aware that the Quality Assurance program is authorized by the management of Teledyne Isotopes and must be followed and implemented at all times? ___ ___ ___
- 1.3 Are you aware of the staffing of Teledyne Isotopes as shown on the organization chart dated _____? ___ ___ ___
- 1.4 Are delivery schedules maintained? ___ ___ ___
- 1.5 Is staffing adequate to perform the work on schedule? ___ ___ ___
- 1.6 Is equipment sufficient and of required quality to satisfy acceptable criteria and also customer approval? ___ ___ ___
- 1.7 Is training adequate so that technician understands and is able to perform analysis adequately? ___ ___ ___

2.0 Quality Assurance Program and Records

- 2.1 Does group manager have a copy of QAM (IWL-0032-395) Copy No. _____, dated _____? ___ ___ ___
- 2.2 Does group manager have a copy of QCM (IWL-0032-365) Copy No. _____, dated _____? ___ ___ ___
- 2.3 Do you understand the importance of controls and the documentation thereof as the basis for the quality assurance program? ___ ___ ___
- 2.4 Do you use sufficient documented controls for each sample to:
 - 2.4.1 maintain sample identification control? ___ ___ ___
 - 2.4.2 insure sample integrity control? ___ ___ ___

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Yes No NA

- 2.5 Do you have available a copy of Regulatory Guide 4.15 and do you follow the provisions in Section "C"? _____
- 2.6 Do you use sufficient documented controls for routine operations to insure:
- 2.6.1 the use of approved forms? _____
- 2.6.2 adequate supervision and approval of all operations? _____
- 2.7 Are documented procedures used exclusively to satisfy the following internal controls:
- 2.7.1 qualification of personnel? _____
- 2.7.2 certification of personnel? _____
- 2.7.3 annual re-evaluation of personnel performance? _____

3.0 Design Control

- 3.1 Are computer programs used for the evaluation and/or calculation of radioactivities? _____
- 3.2 If the answer to 3.1 is yes
- 3.2.1 Is the computer processing satisfactory? _____
- 3.2.2 Is the computer programming documented? _____
- 3.2.3 Has the program been checked by hand to confirm computer calculations? _____
- 3.3 Is design of test equipment used available for inspection? _____
- 3.4 Is log of maintenance of equipment available and up to date? _____

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4.0 Procurement Document Control

- 4.1 Are specifications documented for all reagents and materials that affect quality?
- 4.2 Are approved suppliers selected?
- 4.3 Are materials to be supplied described completely?
- 4.4 Are the purchasing procedures of Teledyne Isotopes followed for all orders?
- 4.5 Are all changes in requirements and design indicated on the purchase order?
- 4.6 Are any special quality criteria or performed requirements clearly specified.

5.0 Instructions, Procedures, Drawings and Records

- 5.1 Are written and approved procedures used exclusively?
Procedures used and date of latest issue are:

- 5.2 Are procedures updated to the latest issue (See procedures handbook)?
- 5.3 Have procedures been approved, signed and dated?
- 5.4 Are approved procedures available at each work station?
- 5.5 Are samples processed as described in the written and approved procedures?
- 5.6 Does laboratory supervisor schedule work output?
- 5.7 Does an inspection system insure that glassware, laboratory equipment, etc. is kept radioactively clean?
- 5.8 Are safety procedures followed?
 - 5.8.1 Wearing of safety glasses?
 - 5.8.2 Wearing of laboratory coats?
 - 5.8.3 Wearing of gloves?
- 5.9 Are technicians aware of procedures for radioactive spills, acid spill, etc.?
- 5.10 Are good housekeeping practices observed.?

6.0 Document Control

- 6.1 Is a supervisor informed if a change in a procedure is considered necessary or advisable?
- 6.2 Are all changes in procedures referred to the department manager and quality assurance manager for approval?
- 6.3 Has document distribution form IWL-22R been signed when receiving all updated procedures?

7.0 Control of Purchased Materials, Equipment and Services

- 7.1 Are copies of purchase orders initialed to indicate acceptance of materials received?

- 7.2 Is traceability of reagents maintained by dating upon arrival? _____
- 7.3 Is shelf life checked and materials removed from use upon expiration? _____
- 7.4 Are audits of vendors conducted in order to assure quality if necessary? _____

8.0 Identification and Control of Materials, Parts and Components

- 8.1 Are all materials, parts and components received initially by the Teledyne Isotopes Receiving Group? _____
- 8.2 Are the materials, parts and components then transferred to the service groups Receiving Room? _____
- 8.3 After unpacking of the materials, parts and components are they assigned an identification number to insure control during processing or use? _____
- 8.4 Are sample receiving forms and all packing slips processed by the service group and forwarded to the accounting department of Teledyne Isotopes? _____
- 8.5 Are samples handled at each stage of processing to minimize and/or eliminate contamination? _____
- 8.6 Is the sample integrity maintained at each operational stage during processing by the responsible service group? _____

9.0 Control of Special Processes

- 9.1 Are special processes performed by qualified personnel? _____
- 9.2 Are written and approved procedures used exclusively for all tasks including special processes? _____
- 9.3 Does an inspection system assure that all special processes conform to written procedures? _____
- 9.4 Are special processes approved by responsible supervisory personnel? _____

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10.0 Inspection

- 10.1 Are examinations, measurements and/or reviews incorporated at specific hold points to evaluate the quality and status of the work being performed? _____
- 10.2 Is each task approved by an independent reviewer other than the original investigator? _____
- 10.3 Are all entries on data sheets initialled by each person involved in generating and calculating the results? _____
- 10.4 Are computation checks performed for verification of a fraction of analyses? _____

11.0 Test Control

- 11.1 Are all radiocounting systems operating? _____
- 11.2 Are the preparations of reference standards or check sources traceable to NBS or the equivalent documented? _____
- 11.3 Is the working standard or check source prepared in the same manner as the unknown or a close approximation thereto? _____
- 11.4 Is equipment which is inoperable tagged? _____
- 11.5 For manually changed sample systems, are check sources measured daily? _____

Are backgrounds measured as frequently as possible? _____
- 11.6 For automatic sample changing systems, are check sources and backgrounds measured for each cycle or batch? _____
- 11.7 For alpha and gamma ray spectrometry equipment:
 - 11.7.1 Is gain and zero level checked and adjusted if necessary? _____
 - 11.7.2 Is the energy resolution checked at least monthly? _____
 - 11.7.3 Is the count rate (or counting efficiency) checked weekly and after power failures and repairs? _____

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Yes No NA

11.8 Is efficiency recalculated as required yearly and when a significant change in system is noted? _____

11.9 Are prompt corrective actions and repairs undertaken? _____

12.0 Control of Measuring and Test Equipment

12.1 The following test equipment is used by this group. _____

1. _____ 2. _____ 3. _____

Calibration _____
Dates _____

12.2 Is the log of repairs and modifications up to date? _____

12.3 Is a regular maintenance schedule followed? _____

12.4 Is new equipment calibrated before being put into use? _____

12.5 Is efficiency and calibration data for new equipment available for inspection?

12.6 Is the maintenance and repair manual of new equipment available for use?

13.0 Handling, Storage and Shipping

13.1 Are procedures specified for inspecting materials and equipment upon receipt? _____

13.2 Are procedures specified for handling material to prevent damage and deterioration? _____

13.3 Are materials stored to maintain quality and integrity? _____

13.4 Are methods for shipping products specified to prevent damage or deterioration? _____

14.0 Inspection, Test and Operating Status

14.1 Are work sheets used in a manner to show the operating status of the work being done? _____

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Yes No NA

14.2 Are entries made on the work sheets of the initials of the inspector or the individual approving the results of the analysis? _____

14.3 Are the data entries on the work sheet initialled by the person performing the task? _____

14.4 Is data in laboratory notebooks complete and legible?

14.5 Are noted books inspected by a supervisor monthly and initialed if approved?

15.0 Nonconforming Materials, Parts or Components

15.1 Are all nonconforming results of sample processing and/or monitoring noted and steps initiated to reject the nonconforming measurement? _____

15.2 Is the nonconforming result isolated and referred to the supervisor for evaluation and corrective action? _____

15.3 Are entries made to insure against inadvertent use of nonconforming results? _____

16.0 Corrective Action

16.1 Are all defective measurements and/or materials labeled clearly and referred to a supervisor? _____

16.2 Is all malfunctioning of equipment referred immediately to a supervisor? _____

16.3 Are prompt corrective actions instituted? _____

16.4 Are all conditions adverse to quality reported and corrective actions instituted? _____

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17.0 Quality Assurance Records

- 17.1 Are all records retained for the period specified in the customer's contract and by authorized person or a qualified designate? ___ ___ ___
- 17.2 Is the originator of each record identified and the date of preparation recorded? ___ ___ ___
- 17.3 Are the results of QC tests made available promptly? ___ ___ ___
- 17.4 Are the results of interlaboratory tests made available promptly? ___ ___ ___
- 17.5 Are results of QC tests analyzed promptly? ___ ___ ___
- 17.6 Are actions to improve results, if required, made promptly? ___ ___ ___
- 17.7 Are duplicate samples analyzed as required? Percentage _____? ___ ___ ___

18.0 Audits

- 18.1 The previous Quality Assurance Audit was conducted on _____, by _____.
- 18.2 Were corrective actions completed and closed from the previous audit? Cite documentation. ___ ___ ___

- 18.3 From this audit check list, has an Audit Review Report been completed? The Audit Review Report was prepared on _____, by _____.
- 18.4 Has the Audit Review Report been distributed to the supervisor of the audited group? ___ ___ ___
- 18.5 Were any deficiencies adverse to quality operations documented during this audit and reviewed with the laboratory manager? ___ ___ ___
- 18.6 Recommended period of time for corrective actions to be completed on the deficiencies _____.
- 18.7 Are any deficiencies so adverse to quality as to require reporting to top management? ___ ___ ___

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AUDIT REVIEW REPORT

LABORATORY/GROUP _____

DATE OF AUDIT _____

SUPERVISOR _____

DISCUSSED WITH _____

AUDITOR _____

DATE _____

OBSERVATION _____

RECOMMENDATION/ACTION REQUIRED _____

ACTION REPLY _____ REPLY DUE WITHIN 30 DAYS

ACTION REPLY SIGNATURES

AUDITOR APPROVAL SIGNATURES

PREPARED BY _____ DATE _____

DATE _____

APPROVED BY _____ DATE _____

DATE _____

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Audit Dates _____ Laboratory _____
Report Date _____ Audit Finding Page ___ of ___ Finding No. _____
Auditor _____ Finding to _____ Reply due _____
Audit Subject _____

Discrepancy Description

Recommendations

Audit Finding Response (Send to Quality Assurance) and Action to Prevent Recurrence

By:

Date:

Response Evaluation/Comments by QA

QA Disposition By

Date

___ Closed ___ Follow-up, See

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Compliance Verification for Audit Citations

Laboratory: _____ Date of Audit Report: _____

Finding Discussed with: _____

Corrective Action to be completed by: _____

Condition:

Corrective Action Recommended:

| <u>Month After Citation</u> | <u>Date</u> | <u>Verified by</u> | <u>Compliance</u> | <u>Noncompliance</u> |
|---------------------------------|-------------|------------------------|-------------------|----------------------|
|---------------------------------|-------------|------------------------|-------------------|----------------------|

| | | | | |
|-------|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |
| _____ | _____ | _____ | _____ | _____ |

If corrective action cannot be taken immediately, state date on which action will be completed:

Signature _____

N45.2.23 APPENDIX A (Sample Format)

| RECORD OF LEAD AUDITOR QUALIFICATIONS | | NAME | DATE |
|---------------------------------------|--|-------------------------|----------------|
| EMPLOYER: | | | |
| 2.3.1 | QUALIFICATION POINT REQUIREMENTS | CREDITS | |
| 2.3.1.1 | EDUCATION – University/Degree/Date – | – 4 Credits Max. | |
| | 1. Undergraduate Level 2. Graduate Level | | |
| 2.3.1.2 | EXPERIENCE – Company/Dates | – 9 Credits Max. | |
| | Technical (0-5 pts.) and Nuclear Industry (0-1 pt.), or Quality Assurance (0-2 pts.), or Auditing (0-1 pt.) | | |
| 2.3.1.3 | PROFESSIONAL ACCOMPLISHMENT – Certificate/Date | – 2 Credits Max. | |
| | 1. P.E. 2. Society | | |
| 2.3.1.4 | MANAGEMENT – Justification/Evaluator/Date | – 2 Credits Max. | |
| | Explain: | | |
| | Evaluated by: (Name & Title) | | Date |
| | | Total Credits | |
| 2.3.2 | AUDIT COMMUNICATION SKILLS | | |
| | Evaluated by: (Name & Title) | | Date |
| 2.3.3 | AUDIT TRAINING COURSES | | |
| | Course Title or Topic | | Date |
| | 1. | | |
| | 2. | | |
| 2.3.4 | AUDIT PARTICIPATION | | |
| | Location | Audit | Date |
| | 1. | | |
| | 2. | | |
| | 3. | | |
| | 4. | | |
| | 5. | | |
| 2.3.5 | EXAMINATION | Passed | Date |
| 5.2 | AUDITOR QUALIFIED CERTIFIED BY (Signature and Title) | | Date Certified |
| 3.2 | ANNUAL EVALUATION (Signature and Date) | | |
| | | | |

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