WORK PLAN FOR
RADIOACTIVE MATERIALS SCREENING
AND REMEDIATION
TENNECO POLYMERS, INC. SITE
FORDS, NEW JERSEY

TENNECO, INC.
P.O. BOX 2511
HOUSTON, TEXAS 77252-2511

Submitted by
SECOR International Incorporated
355 Union Boulevard, Suite 200
Lakewood, CO 80228

Submitted to

Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

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Prepared by:

Dale W. Evans, PE
Chief Engineer

Reviewed by:

James E. Johnson, Ph.D.
Certified Health Physicist

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1.0 INTRODUCTION

SECOR International Incorporated (*SECOR*) has prepared this Work Plan on behalf of Tenneco, Inc. (Tenneco) to outline radioactive materials site screening and remediation services to be performed at the former Tenneco facility in Fords, New Jersey. This Work Plan has been prepared using information obtained from the Nuclear Regulatory Commission (NRC), Region I and information obtained by *SECOR* during a preliminary site investigation conducted in the principal areas of interest. Although the exact limits and extent of the area affected by radionuclides has not been defined, the approach developed will accommodate a broad range of potential radiological conditions that can each be addressed by the proposed work activities. The basic approach will be to perform a concurrent program of site screening, removal of known radioactive materials, a detailed final site survey and confirmation program, and preparation of a final report documenting the validation survey.

Based on the present site conditions, this Work Plan has been prepared to identify a scope of work that will provide for remediation of known source areas, and verification that radioactive materials **have been removed to meet appropriate criteria.** This approach has been structured to meet the objective of providing the most timely remediation.

To outline the tasks to be performed for remedial activities, this Work Plan has divided the proposed scope of work into four tasks, as follows:

- TASK I - Site Screening;
- TASK II - Removal of Radioactive Materials;
- TASK III - Final Site Validation Survey; and
- TASK IV - Final Report.

Because of the uncertainty of the volume of soils, concrete and debris affected by radionuclides, the proposed program will focus on in-field screening and removal of these materials to reduce any residual radioactivity to as-low-as-reasonably-achievable (ALARA) levels. Subsequent confirmatory sampling will then be performed to ensure adequate levels of removal are being achieved. The NRC will be provided with ongoing progress reports of work and it is suggested that a meeting be scheduled to discuss results following completion of Task II. This approach is proposed to facilitate approval of at least Tasks I and II prior to initiating the final site validation survey.

This Work Plan has been prepared in accordance with "Manual for Conducting Radiological Surveys in Support of License Termination", NUREG/CR-5849 (NRC, 1992). Section 2 of this Work Plan provides site background information which provides the basis for the investigation and remediation work. Section 3 presents the remediation protocols for site remediation activities, while Section 4 outlines the specific scope of work for each of the four tasks identified above. Section 5 provides the proposed schedule for remediation activities, and Section 6 establishes the Health and Safety protocols for the work.

The overall objective of the project will be such that a Total Effective Dose Equivalent (TEDE) limit of 15 mrem/year will not be exceeded by an average individual spending full time (2,000 hrs/year) at the site.

2.0 SITE BACKGROUND

The Tenneco facility, and the subject areas of radioactive influences have been evaluated in a general manner and further information will be generated as part of remedial activities. A description of the site, facilities associated with radioactive materials handling, and radioactive influences is provided within the following sections.

2.1 SITE HISTORY

The Tenneco facility was operated as part of Tenneco Chemicals, Inc. and was originally licensed by the Atomic Energy Commission (AEC) to handle up to 3000 pounds of uranium in the form of uranyl nitrate for the production of benzaldehyde. The license No.R.114 was issued on April 19, 1956 and expired as license No.SUB-466 on February 28, 1973. It was noted by Tenneco in a letter dated March 24, 1961 that the facility **lost approximately 200 to 400 pounds of uranyl nitrate per year** as part of the production process. It was also estimated by Tenneco that approximately 150 pounds of uranium as U_3O_8 was recovered annually for return to the supplier.

As part of the license termination process, Teledyne Isotopes, Inc. provided a report to Tenneco that indicated levels of residual radioactivity met guidelines for unrestricted use based on available guidance. Apparently, there was no confirmatory survey performed by the AEC. A recent NRC review of all terminated AEC licenses identified the lack of this final confirmation survey which led to a field reconnaissance visit by the NRC within areas where the licensed materials were used.

Based on available records and discussions with personnel that worked at the facility, the use of uranyl nitrate was limited to one area of the facility that included Building K-12, identified as building 12 on Figure 1, the third converter building, identified as building 12A on Figure 1, and Building K-7, identified as building 14 on Figure 1. Building K-7 was apparently demolished in 1974 while the third converter building and Building K-12 still remain.

The chemical production operations within the three subject structures were apparently segregated from those within other areas of the facility because no other chemical production processes were required other than those within those three structures. Personnel that worked within these facilities were exclusive to these operations and did not work within any other area of the facility. Therefore, these personnel were also exclusively responsible for the operations. These personnel are apparently deceased or have relocated to locations unknown by other facility workers.

The areas of impacts within and adjacent to each of the subject structures have been preliminarily identified as noted on Figure 2. Additional impacts may be present beneath concrete floor slabs or within areas largely inaccessible because of vegetation. Once the site has been cleared of vegetation and impacted floor slabs, a more detailed delineation will be performed. This screening will use a one meter

square grid pattern to ensure adequate documentation is provided as part of the removal and final validation portions of the project.

2.2 SITE PHYSIOGRAPHY

The Tenneco site is located in an industrial area adjacent to the north shore of the Raritan River. Within the outdoor areas influenced by radioactive materials, the site is relatively flat. The remaining areas of the facility also exhibit very little topographic relief. The vegetation in these areas is primarily native grasses and weeds. The northern third of the property is where the manufacturing facility is located. Within this area, numerous abandoned buildings still occupy the site. Three lakes are also located on the north side of the property. The southern two-thirds of the property is primarily a heavily vegetated wetlands area. It appears that this area has been undisturbed by the manufacturing processes. There is a chain link security fence around the facility.

The flat terrain of the site limits the preferential flow of surface water, therefore, water from precipitation and snowmelt typically drains overland to topographic low spots. Surface water from the southern portion of the facility, near buildings K-12 and K-7, was collected in catch basins, piped to a central sump and pumped to a POTW. **This surface water was generated from within a relatively large drainage area of which the subject facilities represented a minor percentage. Therefore, it is not anticipated that the surface water was adversely affected by the licensed operations within these structures. However, work performed as part of the project will include a detailed site walkover survey that will evaluate the extent of any soil impacts that may have occurred from surface water drainage. Further, potential ground water impacts will also be addressed by sampling as outlined within subsequent sections.**

2.3 LOCAL CLIMATE

In general, the climate in the project area is characterized by cool, humid winters and warm, humid summers. Winds within the area typically blow from the southwest quadrant. Rainfall exceeds evaporative losses based on an average annual precipitation of 42 inches per year and an average lake evaporation rate of 35 inches per year. Therefore, a net 7 inches of precipitation is available for surface water runoff or infiltration into the subsurface.

It may be necessary to protect outdoor soil removal areas from precipitation and from potential climatic mechanisms that could enhance migration of radionuclides in soils. Therefore, consideration will be given to limit direct contact of precipitation with exposed removal areas, route surface water around removal areas, and limit winds within removal areas to prevent fugitive dust migration.

2.4 GEOLOGIC CONDITIONS

Previous subsurface investigations for the Tenneco site have been conducted by Converse Ward Dixon, Inc., Geraghty & Miller, Inc., Earth Technology Corporation (consultants for the adjacent property owner) and IT Corporation. These investigations have identified many stratigraphic units typically associated with coastal plain deposits. Locally, the area is underlain by alternating layers of marine and beach deposits consisting of sands, silts and clays. Within any particular sand layer, discontinuous lenses of clay and silt may occur. The six strata underlying the Tenneco site are briefly described below:

1. Fill - Fill material consisting of multi-colored coarse to fine-grained sand, ranging in thickness from 2 to 4 feet, where encountered.

2. Organic Silt Interbedded with Silty Clay - The silty clay and/or organic silt layer is present over the majority of the site. This layer varies locally in organic content and grades into an organic silt. Thickness ranges from 0 to 10 feet and pinches out to the north and east. This clayey silt interfingers with the underlying yellow sand layer. This interfingering of the silt layer decreases as it extends east to west across the site.

3. Yellow-brown to Gray Coarse to Fine-Grained Sand - The top of the yellow-brown sand layer is encountered from the ground surface to approximately 10 feet below the ground surface. This water bearing sand layer interfingers with the organic silt layer as the sand layer dips and pinches out to the south. This unit ranges in thickness from 6 to 22 feet and overlies a gray silty clay.

4. Gray Silty Clay - A gray silty clay underlies the yellow-brown sand layer and the top of this layer is encountered at a depth of 8 to 30 feet below the ground surface. The gray silty clay varies in thickness from 2 to 5 feet and appears to be continuous across the property.

5. Interbedded Gray to Brown to Red-brown Sand and Gravel and Brown to Gray Clay and Silt - This layer appears to be continuous across the site as a semi-confined water bearing sand. The thickness of this layer ranges from 20 feet in the western portion of the site to 40 feet to the east.

6. Blue-gray Clay - A blue-gray to olive green silty clay underlies the red-brown sand and gravel layer. This clay layer has been observed in several borings and appears to be continuous across the site. The thickness of the layer ranges from 10 to 43 feet.

2.5 HYDROGEOLOGIC CONDITIONS

Previous investigations at the site have shown that there are two water bearing zones beneath the site. The two zones are the unconfined yellow sand shallow water table zone and the lower red-brown sand and gravel water bearing zone. The shallow aquifer is separated from the deeper aquifer by the semi-confining gray silty clay layer.

The shallow zone is the upper of the two major water bearing zones. It consists of a yellow brown to gray, coarse- to fine-grained sand and is under unconfined conditions. The shallow water bearing sand has a thickness ranging from 10 to 20 feet below the industrial portion of the site pinching out to the south. This zone is not present throughout the site and is truncated near the sludge lagoon and replaced by the organic silt layer to the south. This shallow zone has a lower boundary consisting of gray silty clay. The upper gray silty clay is approximately 2 to 5 feet thick with an average thickness of 4 feet. The organic silt ranges from 0 to 10 feet thick beneath the industrial portion of the site. A vertical head differential in a downward direction, ranging from 0.16 to 5 feet exists across this layer. This head differential suggests that the silty clay layer acts as a semi-confining layer for the underlying red-brown sand water bearing layer.

The semi-confined water bearing zone consists of an interbedded gray to red-brown sand and gravel and brown to gray clay and silt. This deeper zone is separated from the shallow zone by a gray silty clay or an organic silt layer or both. These layers, either in conjunction or individually, act as a semi-confining layer. The lower blue-gray clay is the lower hydraulic boundary beneath the site. The ground water flow direction in the lower water bearing zone is in a south to southeasterly direction towards the Raritan River.

2.6 RADIOLOGICAL CONDITIONS

The previous radiological site evaluation performed by the NRC and preliminary site investigation conducted by *SECOR* have both indicated that radioactive materials are present at the subject facility. These surveys were independently performed and each survey included surface exposure readings and soil sampling. The results of the two surveys are provided in the following sections.

2.6.1 NRC Investigation

The site survey performed by the NRC included the following diagnostic components:

- Exposure rate survey;
- Soil sampling and analysis; and
- Smear sampling and analysis.

The results obtained from each of these components are outlined in the following paragraphs.

Exposure Rate Survey

The exposure rate survey was performed using Ludlum Model 19 gamma survey meters within and around the buildings of interest. As common within the region, the background exposure rate for outdoor areas was determined to range from 5 to 10 micro-Roentgen per hour (μR/hr). As attributable to naturally-occurring radioactivity within the building products such as bricks and concrete, the background exposure rate within Building K-12 was slightly higher and ranged from 10 to 15 μR/hr.

Using the background values for comparison, a walkover survey was performed to detect areas where residual radioactivity was indicated by readings that exceeded background. Within Building K-12, exposure rate readings ranged from background values to as high as 100 μR/hr. The elevated readings appear to be limited to 2 rooms on the first floor within the 3-story building, including the catalyst preparation room and the converter pad. All other floors exhibited only background readings. These elevated exposure rate readings were also noted within outdoor areas near the southwest corner and the west side of Building K-12. These areas exhibited exposure rates ranging from 60 to 160 μR/hr.

The foundation for Building K-7 was subject to an exposure rate survey that indicated exposure rate readings within the acceptable background range. An 18' x 24' outdoor area at the southeast corner of the foundation exhibited elevated exposure rate readings that ranged from 60 to 100 μR/hr.

The Third Converter building floor was surveyed and indicated elevated exposure rate readings, predominantly within 4 concrete pad areas. These readings ranged from background to 100 μR/hr.

Soil Sampling and Analysis

A total of 7 soil samples were obtained from within outdoor areas adjacent to Building K-12 and the foundation for Building K-7, as well as one sample from a floor drain sump inside Building K-12. These samples were submitted for radiologic analysis which indicated elevated concentrations of uranium isotopes (U-238 and U-235) and Radium-226.

The concentrations measured appear to correlate well with the magnitude of the measured exposure rate readings. As an example, Sample No. 1 exhibited an exposure rate reading of approximately 13 μR/hr and had a concentration of 46 picoCuries per gram (pCi/g), while Sample No. 6 exhibited an exposure rate of approximately 160 μR/hr and had a concentration of 7,210 pCi/g. Each of the soil samples, and the sludge sample exhibited concentrations exceeding the typically used NRC cleanup level of 35 pCi/g for depleted uranium.

Within the soil samples analyzed, it was noted that the radioactivity identified, appeared to be limited to near the surface. This could indicate limited mobility within the subsurface as would likely be attributable to geochemical interactions.

Smear Sampling and Analysis

A total of 16 smear samples were obtained for analysis within different areas of the building. These smear samples were obtained to determine the extent of any removable radioactivity. Analysis of each of the smear samples indicated no removable radioactivity in excess of the typically allowed NRC criteria of 5,000 disintegrations per minute (dpm).

2.6.2 *SECOR* Investigation

SECOR conducted a preliminary site investigation on June 19 and 20, 1995. As part of the site investigation, *SECOR* reviewed site information with personnel from Tenneco and the NRC. In addition, *SECOR* conducted a preliminary gamma exposure rate walkover survey of the areas within and around Building K-12, Third

Converter building, and former Building K-7. Five soil samples were collected from four areas with high gamma exposure rate readings and analyzed for radionuclides. The affected areas and soil sample locations discussed in the following sections are shown on Figure 2.

The gamma exposure rate survey was conducted using a NaI scintillometer, Ludlum Model 19. An initial background survey was conducted to establish background conditions within two different areas. The first area, northwest of building K-12 next to the railroad bed, had an average background reading of 7.7 micro-Roentgen per hour (μR/hr). The second area, east of building K-12, had an average background reading of 7.1 μR/hr. These measurements were made on a 5 meter (m) grid at 1 m above the ground to establish background levels. The background study will be expanded as part of the site remediation activities in accordance with NUREG/CR-5849.

Based on discussions with personnel from Tenneco and the NRC, *SECOR* performed the gamma exposure rate survey on the areas south and west of building K-12, south and west of the Third Converter building, within buildings K-12 and the Third Converter, on the concrete foundation and around the perimeter of the former building K-7, and between buildings K-12 and former building K-7.

The area south and west of building K-12 was found to have the largest areas impacted by radioactive materials and the highest readings from the gamma exposure rate survey. An area outside of the sidewalk on the southwest corner of building K-12, approximately 1200 square feet (ft^2), had readings of at least 10 μR/hr above background readings and were measured at values up to 350 μR/hr. The soils between the sidewalk and the building on the southwest corner of building K-12, approximately 500 ft^2, also had gamma exposure rate readings of at least 10 μR/hr above background and were measured at values up to 80 μR/hr. Two smaller areas outside of the sidewalk on the south side of building K-12, approximately 200 ft^2 combined, had gamma exposure rate readings of at least 10 μR/hr above background and were measured at values up to 50 μR/hr. In addition, one isolated area south of the southwest corner of building K-12, approximately 50 ft^2, had gamma exposure rate readings of at least 10 μR/hr above background and were measured at values up to 22 μR/hr. These areas are shown on Figure 2.

The area around the Third Converter building only had one area with gamma exposure rate readings of at least 10 μR/hr above background rates. This area, approximately 100 ft^2, was located adjacent to the concrete sidewalk on the west side of the building. Gamma exposure rate readings in this area were measured at values up to 90 μR/hr.

Within Building K-12 and the Third Converter building, only minimal areas appeared to be impacted by radioactive materials. The sediment in the east and west ends of the trench drain, which runs the length of building K-12, had gamma exposure rate readings measured at values up to 75 μR/hr. The volume of sediment appears to be less than 20 cubic feet (ft^3) of material, however, the soils below the drain may also be impacted by radioactive materials which would increase the volume. The Third Converter building had one area where gamma exposure rate readings at a crack in the concrete floor were measured at values up to 44 μR/hr. It is difficult to estimate a quantity of impacted materials from this area due the limited knowledge of what may have been impacted below the concrete slab.

The area south of the foundation of former building K-7 was found to have a relatively large area impacted by radioactive materials. An area adjacent to the concrete foundation on the south side, approximately 700 ft^2, had readings of at least 10 μR/hr above background and were measured at values up to 110 μR/hr. Two smaller, isolated areas, less than 50 ft^2 combined, had gamma exposure rate readings of at least 10 μR/hr above background and were measured at values up to 23 μR/hr. One of these areas was measured on the concrete slab, which may indicate that remediation of some of the concrete will be required.

A total of three surface soil and two sediment samples were collected and shipped to Colorado State University for gamma spectrometry analysis. All five samples revealed significant U-238 activity. The highest value was 5,000 picoCuries per gram (pCi/g) and all samples were in reasonable agreement with the NRC values from previous sampling and analysis at similar locations. No radionuclides other than the decay series of U-238 and U-235 were observed. Table 1 summarizes the results of *SECOR*'s analyses.

3.0 REMEDIATION PROTOCOLS

The scope of this Work Plan has been developed to focus on short-term radioactive materials removal and validation within impacted areas of the facility. The scope of work is designed to expeditiously address the remediation of radioactive materials while protecting against exposure to other areas of the facility and surrounding area populations. The following sections outline the general remediation protocols relevant to the methods and procedures used to perform the scope of work outlined in Section 4.0 of this report.

3.1 GENERAL APPROACH

The general approach for the project will focus on the remediation of areas at the Tenneco facility influenced by radioactive materials. An integral part of this work will be to screen all readily accessible areas of the facility, in addition to those known areas of concern. Based on discussion with plant personnel and findings from the NRC and *SECOR* preliminary investigations, it is believed that the areas of concern have been identified. Remedial efforts in the field will be directed toward removal of radioactive soils from outdoor areas and removal of sediments, concrete and debris containing radioactive materials inside the manufacturing buildings. These removal operations will be performed concurrently with a detailed on-site screening and testing program. Following removal operations, sampling will be performed within formerly impacted areas to confirm that target cleanup levels have been met.

To commence field activities, an in-depth source investigation program will be conducted to identify the source of radioactive materials. This program will ensure that readily accessible source materials are identified, so that such materials can be removed during the remediation program and the site can, under NRC guidelines and concurrence, be considered free from radioactive contamination.

3.2 REGULATORY COMPLIANCE

Performance of the proposed work will be performed to meet applicable industry and regulatory standards with respect to workplace health and safety, quality processes, work execution, and other related processes. In general, compliance will be maintained with this Work Plan, and the guidance used for development of the Work Plan, including but not limited to the following:

- **10 CFR Part 19 - Notices, Instructions, and Reports to Workers: Inspection and Investigations**

- **10 CFR Part 20 - Standards for Protection Against Radiation**

- **10 CFR Part 71 - Packaging and Transportation of Radioactive Material**

- **NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination**

- **NUREG-1500 - Working Draft Regulatory Guide on release criteria for decommissioning**

The proposed work activities will remove residual radioactive soils and concrete materials to appropriate cleanup levels. These levels will be equivalent to either background concentrations, or those levels typically associated with upper-bound limits used by the NRC. In general, the approach will be to provide removal of radioactive materials to background or "as low as reasonably achievable" (ALARA) criteria. The rationale for this approach will be to facilitate future unrestricted use of the property with respect to the presence of radioactive materials. Therefore, the most appropriate cleanup protocol for this project will be to remove all radioactive materials to near background levels. This will be possible if binding of the nuclides within the upper soil matrix has, in fact, limited the depth of migration within the subsoils.

The cleanup criteria appropriate for remediation at the facility corresponds with the NRC requirements outlined in the **Federal Register, Vol. 46, No. 205, Friday, October 23, 1981. A summary of this criteria is provided as follows:**

- **Depleted Uranium** - 35 pCi/g;
- **Enriched Uranium - 30 pCi/g;**
- **Natural Uranium Ore - 10 pCi/g.**

These cleanup levels represent the minimum standards which will be applied to removal of contaminated soils, concrete and debris. **Alpha spectrometry will be used to make determinations as to the distribution of the uranium isotopes present. The presence of two or more radioactive contaminants will also be addressed through adjustment of the cleanup levels in accordance with the Unity Rule.**

Surface contamination that may be identified will be subject to remediation using the Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, April 1993. This guidance provides for the following criteria for depleted, enriched, and natural uranium:

- **5,000 disintegrations per minute (dpm) per 100 square centimeters for the average alpha emissions;**

- **15,000 dpm/100 cm^2 for the maximum alpha emissions; and**

- **1,000 dpm/100 cm^2 for removable alpha emissions.**

As part of the evaluation performed in the field for surface contamination, screening will be performed for both alpha and beta emissions.

3.3 PROJECT DOCUMENTATION

One element of validation for the proposed project will be to provide detailed documentation of field activities. Such documentation will include the use of photographs and written descriptions of work activities to support site surveys and screening. This section outlines the various forms of documentation that will be provided to the NRC, and the fundamental considerations included within the documentation program.

3.3.1 Photographic Documentation

Photographic documentation will be used to provide chronological documentation of material removal activities, and site restoration. Photographs will provide a cataloged sequence for each specific activity, such as removal of soils from outdoor areas. Each photograph will be labeled, and placed within a binder specific to the activities documented.

3.3.2 Written Documentation

Photographic documentation will be supported by an extensive written documentation program. The focus of this documentation will be to summarize the following major activities:

- Daily work activities;
- Daily site safety meetings;
- Progress of work in relation to the schedule;
- Factors or conditions that may impact future work activities;
- The results of on-site screening measurements; and
- Summary of on-site laboratory test results.

Documentation will be as explicit and specific as possible to provide comprehensive tracking of all remediation operations, site locations, the management of radioactive materials, and the results of field screening and testing.

3.3.3 Summary of Documentation

Following completion of the project, photographic and written documentation will be assembled in a cataloged manner by date and activity. Organization of these materials will provide an efficient format for review and incorporation into the final report. The final report will thus include documentation, and the supporting narrative necessary to support an NRC clearance regarding the future use of the facility with respect to radioactive materials.

3.4 PROJECT TRACKING

A description of the work accomplished during each month will be submitted to the NRC, and the New Jersey Department of Environmental Protection (NJDEP) on a monthly basis. These monthly project tracking summaries will be used to describe the progress of work and identify site conditions as new information becomes available. A summary of the information that will be supplied with each report is as follows:

- A summary of the project activities for each month, including a summary of progress for each Task as outlined in the Draft Work Plan;
- A summary of site survey and material screening results;
- A summary of any waste that was removed from the site, its location of origin, and the final point of disposal; however, it is planned that waste will be removed in a single shipment;
- A summary of all material screening performed;
- An assessment of the status of the project schedule and any actions required to make up time to meet the schedule;
- A summary of site specific health and safety and liability management considerations made during the month;
- A listing of visitors to the work area, the purpose of their visit, and any observations they made; and
- A summary of work to be performed during the following month.

The information outlined within each monthly report will provide the NRC and NJDEP with a means to review activities and remain up-to-date.

3.5 PROJECT SITE SECURITY

The Tenneco facility is currently an unoccupied manufacturing facility with access controlled by perimeter fences. These fences are 6-foot chain link and encircle the entire perimeter of the facility. **The only point of access is through a locked gate adjacent to the road, and a second locked gate that blocks the lone access road into the facility.** To ensure that the work area is secure, exclusion zone barriers will be established **using applicable OSHA guidance** and signage will be provided, **in accordance with 10CFR 20.1902.**

3.6 MINIMIZATION OF WASTE VOLUMES

Waste materials requiring disposal will likely include soils from outdoor locations, possibly concrete from localized areas of building floors and foundations, and possibly contaminated debris that contains residual levels of radioactive contamination. Removal operations will seek to carefully screen materials to minimize disposal volumes. Such disposal is costly which requires consideration of methods and procedures to minimize the volume of waste requiring disposal.

Material volumes will be minimized by selective removal. Concrete volumes will be minimized by only scabbling concrete surfaces to a depth sufficient for removal of surface contamination. Radionuclides such as uranium have likely only penetrated the upper fraction of concrete surfaces. Core samples will be obtained and tested to identify the extent of radionuclide penetration. The extent of penetration and the location of potential migration pathways, such as cracks and cold-joints, will thus allow a focused approach of removal operations.

Contaminated soil volumes will be reduced by selective removal through excavation with small excavating equipment or hand tools. Previous screening did not delineate the exact extent of soil contamination, either vertically or horizontally, however, based on available information, it is anticipated that the contamination is somewhat widespread and removal of soils with heavy equipment will be appropriate.

3.7 CONTINUOUS SITE SURVEYS AND SCREENING

An important consideration of the project will be to document that all residual radioactivity has been removed and properly disposed of in a licensed nuclear disposal facility. Similarly, documentation of the screening performed within non-contaminated areas will provide a permanent record for validation that no additional significant radioactive sources remain at the site.

The primary element of documentation will be the results obtained from site surveys and screening of residual radioactive materials that are removed. Surveys and screening will include both scintillometer readings and shielded gamma-ray spectrometry readings from samples obtained within grids established specifically as field screening removal areas. These activities will be performed on a continuous basis to provide assurance that no residual radioactive contamination exists within any material, except for those shipped to the licensed disposal facility.

The site survey and screening program will include both general walkover surveys and surveys of areas with documented radioactive influences. The survey and screening activities will be employed to identify any residual radioactive contamination within concrete, soils, structural components, or other materials, not previously identified as being contaminated. Surveys will focus on broad areas such as floors and soils external to buildings. Screening will be performed on individual site materials that may have been influenced by previous facility operations, including all accessible building components, such as walls, roof joists, roofing, shielding, and utilities, among others.

To support site survey and screening activities, an on-site laboratory will be used. This laboratory will be housed in an office trailer and will include a shielded gamma ray spectrometer. Using an on-site laboratory will provide same-day analysis results and will allow more samples to be collected and analyzed.

3.8 GAMMA EXPOSURE RATE SURVEYS

Gamma exposure rate surveys will be performed within areas previously identified as being influenced by radioactive materials. These surveys will thus include evaluations of the following:

- Gamma exposure rate surveys within an area designated for the determination of background exposure rates;

- Gamma exposure rate surveys within the affected areas, as shown on Figure 2;

- Gamma exposure rate surveys within unaffected areas of the facility that have not been identified as being influenced by radioactive materials;

- Gamma exposure rate surveys within affected zones (hot spots) of indoor areas; and

- Gamma exposure rate surveys within unaffected areas of the existing buildings not previously identified as being influenced by radioactive materials.

These surveys will be performed using both field measurements and by obtaining samples for laboratory testing. The survey equipment in the field will include the use of an NaI scintillometer, while the analysis at the field laboratory will be performed using a Germanium detector, shielded spectrometry system. In support of gamma exposure rate surveys, final laboratory analyses will be performed using Germanium spectrometry in a contract laboratory with appropriate QA documentation.

3.8.1 Outdoor Gamma Exposure Rate Surveys - Background Areas

An outdoor gamma exposure rate survey will be performed prior to the commencement of field activities to determine the appropriate range of background concentrations. This survey will form the basis for site evaluations and the identification of potential areas with elevated radiation levels.

The background determination will be performed by screening an area of the site that has not previously been subject to active facility operations. Based on the walkover survey of the unaffected areas of the site, areas for the background survey will be selected.

The format for background assessments will be to obtain representative gamma exposure rate readings within a 30 meter square grid. A 1-meter grid component system will be used resulting in a total of 900 readings both at the ground surface and at a height of 1 meter above the ground surface. Each of the readings will be obtained using the same scintillometer. This instrument will be recalibrated prior to the exposure assessment.

The exposure readings obtained from within the background assessment area will be recorded using the computerized database system. Once all exposure readings have been input, the sample population developed will be numerically evaluated to determine appropriate statistical values. These values will be used to determine the statistical range associated with background exposure readings.

3.8.2 Outdoor Gamma Exposure Rate Surveys - Affected (Hot Spot) Areas

As shown on Figure 2, several areas of the facility have been previously identified as exhibiting the presence of radioactive materials. These areas will be subject to the removal of radioactive materials to below applicable cleanup levels and/or to background concentrations. To guide these removal efforts, it will be necessary to perform continuous field screening and analysis.

Within removal areas, soil screening will be performed by using a scintillometer to determine exposure rates within the excavations. Samples will also be obtained for analysis to determine the concentrations of various radionuclides that may be present within the soil matrix.

The gamma exposure rate surveys within each area will be performed using a 1 meter grid system for orientation within each removal area. These grids will be marked on the ground surrounding the perimeter of the removal area by using sequentially marked stakes. Each grid will also be developed into a detailed base map that will allow tracking of all gamma exposure rate readings, as well as all soil sampling and analysis events by depth.

Removal operations will be performed by excavating soils with small excavating equipment and hand tools from within areas exhibiting exposure rates greater than background. Samples will be taken within these areas and will be subjected to shielded gamma spectrometry analysis at the on-site laboratory for correlation purposes. The correlations developed will be used to guide removal operations and to facilitate removal of only those soils exhibiting elevated radiation levels.

3.8.3 Outdoor Gamma Exposure Rate Surveys - Unaffected Areas

No previous gamma exposure rate surveys have been performed at the facility to identify the potential presence of radioactive materials in additional areas. This survey will include a walkover evaluation of the entire area of the facility and will include the analytical evaluation of samples obtained from various areas of the facility. The purpose of this evaluation will be to assure, to the extent possible, that no further influences are present at the facility.

The exposure survey of other areas will be performed by obtaining gamma exposure rate readings both at the ground surface and at a height of 1 meter. These readings will be correlated to sample analyses of materials subjected to shielded gamma ray spectrometry measurements. Since an on-site laboratory will be available for such determinations, a high frequency of analysis will be performed in relation to the scintillometer readings. The exact frequency of sampling and the size of the grid used for exposure readings and verification samples will be determined subsequent to the conduct of the initial removal program. A 10-meter grid interval is tentatively planned.

3.8.4 Indoor Gamma Exposure Rate Surveys - Affected (Hot Spot) Areas

A detailed gamma exposure rate survey will be performed inside Building K-12 and the Third Converter building to identify the exact locations of hot spots as previously indicated by the preliminary screening conducted by *SECOR*. These hot spots will be screened in the field using the scintillometer to obtain both surface exposure rates and the exposure rates at a height of 1 meter above the surface of the concrete. Samples of concrete within identified hot spot areas will be obtained by chipping the surface, and by obtaining core samples which penetrate through the concrete. Core samples will be used to determine the depth of penetration of the nuclides present.

Within the hot spot areas, grids will be established to cover the complete area. The grids utilized will be established using 1-meter square components that will reference a numbering system that will be supported by a detailed drawing. These grids will serve to provide locations for documentation of scintillometer readings and sample collection and analysis. Each grid location will be marked on the surface of the concrete, and will be maintained throughout the removal program, until final validation indicates that the areas have been remediated.

Exposure readings and sample analysis results will be presented using plan view representations of each hot spot area. A detailed data base management system that summarizes the results of exposure readings, on-site sample analysis, and final laboratory validation analysis will also be maintained.

3.8.5 Indoor Gamma Exposure Rate Surveys - Unaffected Areas

Walkover surveys will be performed to validate that no elevated radiation levels exist at other locations. An evaluation will be made throughout the facility to ensure that all areas with elevated radiation levels are managed appropriately. Because of the numerous buildings at the facility, it is not practical to establish a detailed grid system. Therefore, the approach will provide for walkover exposure readings to be obtained within each of the buildings. Buildings exhibiting exposure rates not within the statistical range of background values will be subject to further evaluation, and if appropriate, removal operations and validation sampling.

For the purposes of this project, the statistical range of background values used to guide field screening will be within the 95-percent confidence level for all radioactivity measurements. If field evaluations indicate radioactive materials are present greater than 2.0 standard deviations above the background mean, then additional evaluations in the form of sampling will be made. Samples obtained from these locations will be analyzed to develop a new mean for the impacted area and compared to the background mean value.

The management of walkover exposure reading data will be performed by using a detailed drawing of the site as a base map for notation purposes. Any points exhibiting elevated readings will be highlighted and the removal or validation procedures will be appropriately noted.

3.9 BACKGROUND CONCENTRATIONS OF URANIUM

Background concentrations of uranium in soils will be determined for comparison to gamma exposure rate surveys and for the evaluation of soil cleanup activities. The background concentrations of uranium in surface soils will be determined through sampling and gamma ray spectral analysis. U-238 may be determined in this manner and it is assumed that this activity concentration will be sufficient to determine the mean background value and the associated standard deviation. A total of 50 samples will be collected from within background areas as close as practicable to the impacted area. Both arithmatic and geometric means and frequency distributions will be tested to determine if the distribution is log-normal. Based on the results of the analyses, a background value will be established for naturally occurring concentration of uranium.

3.10 MATERIALS SAMPLING AND ANALYSIS

Soil and concrete materials will be sampled and analyzed for radionuclide and chemical concentrations. Groundwater samples may also be obtained for similar analyses for areas that may have potentially been impacted by the previously identified radioactive materials. All sampling will be performed using *SECOR* Corporate protocols appropriate for the media being sampled. Most of these procedures are well established, although the nature of the field work requires some additional considerations. The following sections briefly outline some of the added considerations for sampling of these materials.

3.10.1 Soil Sampling

Soil sampling will be performed to provide materials for shielded gamma ray spectrometry measurements. It is assumed that soils will have only residual soil moisture and not require any more than minimal amounts of oven drying. The following elements will be required for all sampling operations:

- Samples will be obtained using a 4-inch diameter steel drive sampler. **Collected soils will be dried and ground if necessary, and packed tightly into clean 1-quart paint cans;**

- Filled paint cans will be vacuumed to remove residual soils from the sealing rim that could prevent proper sealing of the cans;

- Lids will be pressed onto each can and will be sealed with silicone;

- Each can will be labeled with a permanent ink pen with the following information:
  - Grid location (3-dimensional identification)
  - Date of sampling

- Name of sampler
- Characteristics of sample
- Tare weight of can
- Net weight of dry soil

- A summary of each sample will also be provided within the field logbook developed for the project; and

- A base map summary of all sample locations.

3.10.2 Evaluation of Building Surfaces (Removable and Fixed Surface Contamination)

Within building areas, structural materials may have been impacted by previous operations. Within the buildings previously involved with handling uranyl nitrate, 100-percent of the floor areas and adjacent walls will be screened to determine the presence of any residual radioactivity. Within Buildings K-12 and the Third Converter Building, overhead structural support, ventilation systems, floor grating, or other potentially impacted materials will be similarly screened to determine the presence of any residual radioactivity. This screening will be performed using the gamma survey meter and a G-M meter. Where detectable activity is measured above the established background gamma exposure rates, wipe samples will be obtained to determine if the activity is removable or fixed within the subject building materials.

Wipe samples to determine removable surface activity will be obtained by wiping an area of approximately 100 square centimeters (cm^2) using a dry filter paper while applying moderate pressure. The filter papers will be evaluated using the G-M meter and the on-site gamma spectroscopy laboratory for field determinations. Detailed evaluations of each wipe sample will also be made through shipment of samples to Colorado State University for gas-flow proportional counting.

Once the results of wipe sampling have been obtained and reviewed, if the activity is removable, the entire area exhibiting such elevated activity will be subject to vacuuming, scraping, or other applicable method of removal.

If the activity within building materials is not removable, then samples of the surface material will be collected to define the size of the "hot spot" area. Sample collection will typically be performed using the protocols outlined in Section 3.10.3. These samples will be obtained for analysis using the G-M counter and the on-site gamma spectroscopy laboratory. The results of analyses on these samples will be used to determine the amount of removal required to meet applicable cleanup criteria. Each of these samples will be labeled as outlined in section 3.10.1 and retained for potential future use.

3.10.3 Concrete Sampling

Concrete samples will require analyses similar to those for soils. However, because potential radioactive materials concentrations may be limited to only surface areas, some modifications may be appropriate to limit the volumes of concrete collected.

In general, concrete samples will be obtained for two purposes. First, core samples will be obtained to allow determinations of the depth of radionuclide penetration. Secondly, samples of concrete will be required within potential hot spot areas to determine the potential range of concentrations of radionuclides that may be present.

Core samples will be obtained from within selected hot spot areas to allow subsequent evaluations of radionuclide penetration depths. The depth of penetration will be identified by sawing thin layers of the core in a perpendicular orientation to the longitudinal axis. The resulting wafers will then be subjected to shielded gamma spectrometry to determine the concentration of radionuclides within the sample.

In the event that the concrete matrix is not structurally competent enough to allow adequate development and testing of wafers, then the surface may be carefully ground in measured increments. These increments will be 1/32-inch, and will be followed with a thorough cleaning of the ground surface of the core. The core sample will then be placed within the shielded spectrometer for testing. The spectrometer will be specially oriented to shield all of the exposed core cylinder, except for the end being measured. If readings measured are above background levels, then additional grinding will be performed in increments until measured readings are equivalent to background concentrations.

Concrete obtained from within hot spot areas will be tested to identify the extent of the surface areas requiring removal. Samples of concrete will be limited to chips taken by using a special fracturing chisel. These chips will be collected and placed within containers that will fit within a specially-designed holder within the gamma spectrometer.

All concrete materials sampled for testing purposes will be carefully logged in the field notebook. The location of each sample will also be noted on a detailed grid sheet developed for each specific area of the facility buildings being investigated.

3.10.4 Groundwater Sampling

As noted within subsequent sections, periodic sampling of soils will be performed following NUREG / CR-5849 guidance from the soil surface to the surface of the groundwater. Within selected locations, samples of groundwater will be obtained to determine the extent of any impacts on groundwater quality. The locations of groundwater sampling will be based on the site conditions identified. However, typically groundwater samples will be obtained from beneath each of the outdoor soil excavation areas, as well as areas downgradient of the structures where uranyl nitrate was used.

Ground water samples will be obtained through the use of temporary well points that will be left in place until the final validation survey has been completed. These well points will be driven into the ground and will be sampled following typical EPA groundwater sampling protocols.

If field activities indicate that radioactive materials may have impacted groundwater quality, then further samples of groundwater will be obtained **to determine the horizontal extent of such impacts**. . The following elements will be required for all sampling operations:

- Purge the well until the groundwater parameters of pH, specific conductance, and temperature have stabilized or a minimum of three borehole volumes of groundwater have been removed from the well;

- Fill sample containers with groundwater;

- Measure the pH, specific conductance, and temperature of the groundwater recovered by obtaining a separate sample; and

- Note the location and time of sampling of all samples collected on the site base map along with the date of sampling and a sample identification number.

All water samples will then be packaged and shipped to a selected analytical testing laboratory following appropriate procedures and protocols. **Analyses on these groundwater samples will be performed to determine the concentration of applicable uranium isotopes and any other radionuclides identified within the soil samples analyzed. All analyses will be performed using appropriate analytical protocols and QA/QC.**

3.10.5 Subsurface Piping and Drainage Feature Surveys

Subsurface piping, catch basins, and other related drainage features may be associated with various portions of the proposed program. Various pipe penetrations through the floor have been noted as part of previous surveys and screening of these pipes will be performed to validate whether they are impacted or whether they will require some form of remediation. This screening will be performed using an G-M end window probe attached to a cable capable of allowing the probe to be inserted into the pipe. If evidence of impacts are identified, the pipe will be removed and decontaminated to meet applicable criteria or otherwise prepared for disposal.

In addition to process piping, a drainage trough in the center of the building appears to have been used to collect impacted liquids. The ultimate fate of these fluids is unknown and will be assessed by further field evaluations. Therefore, the trough will be screened similar to other concrete areas, as will any cracks and the underlying subsoils.

3.10.6 On-Site Gamma Spectroscopy

Soils samples collected within paint cans, as outlined within Section 3.10.1, will be subject to on-site gamma spectroscopy. This analysis will be provided using an on-site laboratory placed inside the field project office. The laboratory provides the use of a sealed lead-lined counting chamber sealed inside a concrete block encasement. The counting chamber positions the one quart paint cans directly over a 2-inch Ge crystal., while counting is provided using a Multi-Channel Analyzer. The counting chamber was originally sized for the one quart paint cans and is covered with a sealed lead cap. This configuration thus provides the geometry necessary for proper counting.

Using the gamma spectroscopy system outlined, samples will be subjected to analysis as they are obtained. Based on the geometry of the system, a 20-minute count will provide a lower limit of detection (LLD) for U-238 of 5 pCi/gram at the subject facility. As a calibration to support field analysis, a set of soil standards in one-quart cans on loan from Colorado State University will be available for counting. The activities of the can standards are traceable to NIST and have been used for the calibration of radionuclides measured as part of the EPA cross-check program for many years. The evaluation of samples at the site will be made through development of a calibration curve of counts per gamma ray versus gamma ray energy. From this curve, the counting yield (efficiency) for each important gamma ray may be determined.

All data developed as part of on-site evaluations will be documented with respect to the sample number, the location, the measured concentration, and other related information. This information will be retained using a database system to effectively track all sampling and analysis results and provide a cross-check with both field gamma surveys, as well as off-site validation surveys.

3.10.7 Air Monitoring and Sampling

Air monitoring and sampling will be performed during any indoor or outdoor operation that may generate dust aerosols. Samples will be collected using a high-volume sampler using a flow rate of approximately 36 cubic feet per minute (cfm). The flow rate will be continuously monitored using a calibrated flow meter (rotameter).

The air sampler that will be used to support the work will be a Model HV-1 as manufactured by F and J Specialty Products, Inc.. The filters used in the flow meter will be BM-2133, or equivalent. The flow meter will be calibrated against a large spirometer at Colorado State University.

3.10.8 Radiation Detection and Measurement Equipment

All radiation detection and monitoring equipment used will meet applicable criteria for detection of radionuclides at the facility within a reasonable degree of accuracy. The following survey instruments will be made available for use as part of the project:

1. Scintillation Exposure Rate Meter - Ludlum Model-19 with two time constants. This instrument will be used to detect gamma exposure rates.

2. Alpha Scintillation Survey Meter - Ludlum Model-12 with a ZnS(Ag) probe Model 4S-2 with a window area of 11 square centimeters. This instrument will be used to detect fixed surface contamination.

3. Gieger-Mueller (G-M) Survey Meter - Ludlum Model-12 with Model 44-7 probe with a window area of 9.1 square centimeters and a window density thickness of 1.4 milligrams per sqaure centimeter. This instrument will be used to detect fixed surface contamination and for screening personal clothing. A pancake G-M probe will also be available.

Each of the instruments noted are owned and rented by the Department of Radiological Health Sciences, Colorado State University in Fort Collins, Colorado. Each of these instruments is calibrated at CSU against sources traceable to NIST using the following protocols.

- Exposure Rate Scintillation Survey Meter - Calibration is against a Pressurized Ionization Chamber (PIC) calibrated against a NBS (now NIST) Ra-226 sealed source. Since every NaI(Tl) instrument over responds to low energy gamma-rays, a plot of the measured exposure rate against the true exposure rate is used to correct all measured readings. The calibration procedure used is approved by the Colorado Department of Public Health and the Environment, Radiation Control Division. The CSU Radioactive Material License number is 02-19.

- Alpha Scintillation Survey Meter - Calibration is against an electroplated Am-241 source traceable to NIST. The calibration procedure used is approved by the Colorado Department of Public Health and the Environment, Radiation Control Division. The CSU Radioactive Material License number is 02-19.

- G-M Survey Meter - Calibration is against a Cs-137 point source. The exposure rate is calibrated against a Victoreen condenser -R meters, calibrated against a Free Air Ionization Chamber. The beta detection efficiency is calibrated against a Sr-Y-90 plated source. The calibration procedure used is approved by the Colorado Department of Public Health and the Environment, Radiation Control Division. The CSU Radioactive Material License number is 02-19.

To support daily field use of these instruments, an additional sealed Ra-226 point source, the Am-241 plated source, and the Sr-Y-90 plated source will be used to verify proper operation of instruments prior to each day's use. The measured response of each instrument will be maintained within a dedicated site log book. The response of each instrument will be compared to the mean response. Any deviation from the mean response greater than two standard deviations will be cause for investigation and, if appropriate, recalibration. In all cases, the measured exposure rate or count rate will be expressed with only two significant figures.

The lower limit of detection (LLD) and detection efficiencies for each instrument is provided as follows:

Instrument	LLD	Efficiency
Ludlum Model-19	1.5 uR/hour	N.A.
Ludlum Model -12 Alpha Survey Meter	300 dpm/100cm2	0.28cpd
Ludlum Model-12 G-M Survey Meter	3,800 dpm/100 cm2	0.20 cpd

The LLD (MDA) values shown have been calculated as described in NUREG-0472 and NUREG/CR-5849.

3.10.9 Sample Collection and Analysis QA/QC

Quality Assurance (QA) and Quality Control (QC) measures will be employed to ensure that the data developed is accurate and adequate for the intended use. In general, quality assurance refers to the planned and systematic actions necessary to provide confidence in the results of the monitoring being performed. Quality Control refers to those QA activities that provide a means to control and measure characteristics of measurement equipment and the processes used to establish requirements. Thus quality assurance includes quality control and is required to demonstrate compliance with the standards set forth within this Work Plan, and those established by the NRC. Accordingly, SECOR's QA/QC program for this project will provide written documentation of each of the following:

1. Training and supervision of all personnel.

2. The procedures used for all sample collection and analysis, including the location and results of field screening and analysis.

3. Initial and subsequent periodic calibrations for all measuring instruments. Such calibration will be traceable to a primary method or standard, generally NIST.

4. The procedures used for field and laboratory coding of samples and the format used for chain-of-custody monitoring.

5. The procedures used for data reduction procedures, such as the computer software employed.

6. **Validation of the participation in a cross-check program, such as that used by the EPA, by the laboratory used for off-site analyses.**

7. **The protocol used to assign an individual with responsibility for QA activities.**

8. **The procedures used for periodic audits of the QA program and the results of such audits during the duration of the project.**

3.11 SITE RESTORATION

Once site decontamination activities are completed, the site will only be restored to the extent that no adverse environmental impacts are caused. Minimal restoration will be performed since it is expected that the existing facilities will be demolished and the surrounding areas regraded. The primary restoration will be accomplished using a combined regrading and revegetation program. The essential elements of this program will include the following:

- Placement of fill materials within excavation areas to enhance long-term surface stability; and
- Re-establishment of surface water drainage paths.

4.0 SCOPE OF WORK

Based on the general considerations and supporting field protocols outlined in the previous section, a scope of work has been developed. This scope of work will be performed in four tasks that will be implemented to assure that an adequate understanding of site conditions is developed prior to performing the required field work and that adequate field confirmation is provided for removal operations. A summary of the work to be performed within each of the four tasks is provided within the following sections.

4.1 TASK I - PRELIMINARY SITE SCREENING

To delineate the exact areas for removal of radioactive materials, it will be necessary to perform a baseline field screening program. This program will not seek to provide detailed information on the horizontal and vertical extent of radioactive materials, as much as it will provide a general delineation of the areas requiring removal operations. The following sections outline the elements of the screening program and the protocols used for on-going screening during material removal performed as part of Task II.

4.1.1 Set Up On-Site Laboratory

An on-site laboratory will be established at the facility to allow rapid turnaround of sample analysis. It is anticipated that same-day turnaround can be provided, which will greatly enhance both the initial screening and site remediation operations. The laboratory will include a shielded gamma spectrometer with a high-purity germanium detector and will be set-up in a trailer adjacent to the outdoor work areas. The laboratory will be supported by a broad array of field screening equipment, as appropriate for field sampling and analysis.

4.1.2 Survey of Affected Areas

Previous field investigations conducted by the NRC and *SECOR* identified several areas with elevated gamma exposure rate readings as shown on Figure 2. These areas will be delineated using a surveyed grid system for documentation purposes. This grid will use one meter square row and column widths. Once the grid is established, field screening equipment and the on-site laboratory will be used to screen these areas. This screening will include an evaluation of the facility grounds and buildings. Areas identified as exhibiting exposure rates in excess of typically-required maximum thresholds will be delineated for subsequent remediation operations. Within the outdoor areas, the areas are expected to be contained within the limits of the facility property. Within the manufacturing building, the areas are assumed to be represented by small hot-spots on the surface of concrete floors.

4.1.3 Survey of Unaffected Areas

Areas outside of those expected to be affected by radiation, unaffected areas, will also be evaluated to determine the potential presence of radioactive materials. The format for a general site survey will be to perform initial screening of unaffected areas concurrent with the survey for the affected area. Therefore, if additional removal operations are appropriate, such operations can be performed as part of the planned remediation program.

The screening performed will include a walkover survey of the entire property. The format for the survey will be to focus on areas with a more distinct likelihood of having radioactive materials, rather than at totally random grid points. The screening performed will include evaluation of measurable exposure values, and will be supplemented by analytical laboratory analysis of samples from critical locations by the on-site laboratory. The areas of the facility subject to additional focus will be those that may have been influenced by migration of radioactive materials from known source areas.

The location and results of all screening and sample analyses will be compiled in the project data base and located on scale drawings of the facility.

4.1.4 Perform Background Survey

After the walkover survey is conducted for the unaffected areas of the site, areas will be selected for the background survey. Based on the walkover survey of unaffected areas, it can be assured that the area selected for the background survey is in an unaffected area of the site. The background survey will be conducted in a gridded area as discussed in Section 3.8.1 and the results documented and reduced to establish the background levels for the site.

4.1.5 Establish Work Zones

Once affected and unaffected potential removal areas have been screened and removal areas delineated, remediation activities will commence by removing contaminated soil and concrete. These remedial activities will be planned using work zones that will provide adequate personnel protection, and protection against external influences on radioactive materials, such as atmospheric conditions. These work zones will be considered exclusion zones, except to appropriate personnel, and will be marked with barricades, temporary fencing, and signs. **The barricades and fencing will be arranged in accordance with applicable OSHA guidance while signs will conform to those required by 10CFR 20.1902.** These work zones will remain as exclusion zones until the results from confirmation sample analysis have been reviewed and indicate that concentrations of radioactive materials are at or below allowable levels.

4.2 TASK II - REMOVAL OF RADIOACTIVE MATERIALS

Radioactive materials contained within soil and possibly concrete floors and debris will be removed to appropriate cleanup levels. The remedial operations required as part of these removal activities and the considerations appropriate for management of the radioactive materials are outlined within the following sections.

4.2.1 Soil Removal Options

Radionuclide influences on soils have been identified at several locations of the facility, as shown on Figure 2. The work required to remove the soils at these locations is outlined within the following paragraphs.

Previous work by the NRC and *SECOR* identified several areas of soils containing radioactive materials near buildings K-12 and the Third Converter building and on the K-7 concrete pad. These soils are expected to necessitate removal to meet cleanup levels. The extent of removal required to meet cleanup levels is presently unknown and will be determined in the field during removal operations. However, for estimation purposes, it is assumed that six to twelve inches of the near surface soil over a 3000-square-foot area will require removal in the outdoor areas shown on Figure 2. This is equivalent to 3000 cubic feet of soil.

Removal of soil contamination will be performed, to the extent practicable, by small excavation equipment and hand excavation. Removal locations will each be considered exclusion zones to control access and the size of the excavation area. Excavation activities will be performed carefully to prevent lateral spreading of contamination to other areas.

Excavation operations will include soil removal from both outdoor and indoor areas. Previously identified impacted soils have been noted beneath the floor slabs. These impacts are likely attributed to solution migration through cracks into the subsurface soils. These soils will be removed by first sawcutting and removing the slabs to expose the soils. The concrete removed will be screened and managed as noted in Section 4.2.2. Soils beneath the slabs will be excavated in a manner similar to those within outdoor areas.

In general, soil excavation will proceed within each one meter grid component, from the ground surface to the base of the area influenced by radioactive materials. Lateral excavation will be performed within each removal area, only after screening within the base of the excavation reveals removal to attain background exposure rates have been attained. As the lateral excavation continues to expand, the vertical side walls will also be screened to determine the point at which removal provides results of background exposure rates. Excavated material will be transferred directly into 1 cubic yard (cy) Supersacks for shipping to the appropriate disposal facility or stockpiled in a central area for bulk shipment in an end dump or roll-off container to the disposal facility. If Supersacks are used, they will be underlain by a sheet of polyethylene geomembrane material during excavation for collection of any spilled soil residues. Once full, the Supersacks used to contain soils will be sealed, labeled, as appropriate, and placed within a secure storage area, until removed for disposal. If bulk disposal is used, the excavated soils will be placed on a geomembrane liner and covered with another geomembrane liner until the soils are loaded out for transportation to the disposal facility.

Control of excavation areas will be enhanced by using a temporary shelter over excavations to prevent weather-related impacts related to wind or precipitation, if required. Use of the shelter will be especially important for prevention of weather-related impacts in areas where excavations may be left open overnight. As an additional means to control the lateral extent of excavations, a surface excavation template will be used. This template will limit the extent of sidewall caving and the resulting disposal of clean soils that may slough into excavations. If necessary to prevent caving, the template may be supplemented by the use of a polymeric soil sealer to serve as a binder for enhancement of stability within near surface soils.

A key component of the soil excavation process will be the screening necessary to selectively remove only those soils exhibiting radioactive influences. Because of the high costs associated with disposal of radioactive materials, waste volumes will be carefully managed. Effective management of material volumes will thus require on-going screening and sample analysis. For the proposed project, screening will be performed using field instruments, while sample analysis will be provided using an on-site laboratory.

As excavation operations progress, the excavated material will be placed in shallow soil trays and will be evaluated by the on-site laboratory. Soils that exhibit radioactive influences will be disposed, while other soils will be segregated. Segregated soils will be subject to a final screening once all removal operations have been completed.

Following removal of contaminated soils, final confirmatory samples will be obtained from excavations at a statistically-valid frequency, **as outlined within Section 4.3.1**. These samples will be tested within the on-site laboratory and, if no further activity is noted, selected samples will be submitted for off-site laboratory analysis using a high-purity germanium spectrometer. If no remaining radioactive material exists, segregated soils will be placed back into the excavations, followed by fill soils as necessary to restore the surface to the original grade. **The backfilling of these areas will only be performed following the confirmatory survey by the NRC of both the excavation and the backfill soils.**

4.2.2 Concrete Removal Options

The surface of concrete floors within certain areas of the building K-12, the Third Converter building and former building K-7 have been tentatively identified as being influenced by residual amounts of radioactive materials. These materials may require removal and disposal within a licensed facility. Details on the removal program and the potential range of considerations required for work in the manufacturing building are summarized in the following paragraphs.

If concrete exhibits gamma exposure rates greater than the background levels near areas identified as hot-spots. The extent of contamination within hot spot areas will be mapped using a one meter square grid component system. Therefore, removal of concrete will occur in units of one square meter.

One option for the removal of concrete surfaces affected by surface activity will be to cut and remove for disposal the excavated concrete. **Sawing of the concrete will be performed using industrial grade saws equipped with a water feed to limit dust generation and promote cutting. The flow of water will be minimal and will be collected from the concrete surface being sawed using a wet-vacuum. Water that could enter the cut will be similarly collected to the extent possible. The screening performed as part of the on-going removal activities will identify whether any water-related excursions within soils immediately beneath the floor slabs have occurred and whether they require remediation. Given the small volume of water used,**

waterborne migration will be limited. Once the concrete sections have been removed, screening will be performed within each of the sawcut areas. This screening will to evaluate the extent of any radioactivity, document the conditions so that a determination of any required remediation can be made. If radioactive impacts are noted within the soils beneath the slab, removal of these soils will be performed in accordance with the applicable protocols of this work plan.

Concrete volumes to be removed will be minimized to the extent practicable to limit off-site disposal volumes. **However, all concrete covering potentially impacted subsoils will be removed to the extent necessary to promote safe removal and final validation of the effectiveness of removal. Concrete that is impacted and that which is non-impacted will be segregated.** The impacted concrete will be packaged and disposed along with the soils, **while non-impacted concrete will be stockpiled for management as part of future demolition activities.**

Given the radionuclides present, contamination should exist only within the upper surface of the concrete (upper 1/4-inch or less). Removal of the entire concrete floor section, and subsequent disposal could be very costly and may not be necessary if contamination is confined to the near surface. Therefore, the most viable approach for removal of any hot-spots will be to scabble the concrete surface to remove the upper horizon that contains radioactive materials. Effective removal of the upper surface should be capable of reducing the measured gamma exposure rate to approximately background levels.

Prior to scabbling operations, floors will be closely inspected to identify any cracks that may have served as conduits for migration of radioactive materials to the subsurface. Such conduits may have resulted in radioactive influences within the face of cracks, and underlying near surface soils. If such contamination is present, crack areas will be saw-cut and removed, along with any residual soil contamination. All contaminated material will immediately be removed for disposal.

The scabbling operations will require control to limit potential generation of fugitive dust that could spread contamination to non-contaminated areas. The dustless scabbling equipment used will provide a dust-free environment because of an applied vacuum that pneumatically transports concrete chips and dust directly into drums suitable for final disposal. This collection system is equipped with a level controller that automatically shuts the system off once the drums are filled.

The scabbling machine typically removes approximately 1/8-inch (3.2 mm) of concrete with each pass. However, manipulation of the cutter head can be performed to provide for a uniform depth of removal of as little as 1/16-inch (1.6 mm), if the depth of contamination is limited to just the upper concrete surface.

The depth of penetration will be influenced by the void structure within the concrete surface, as influenced by the method used for initial placement and hydration. The depth of scabbling will be evaluated by obtaining core samples to determine if a reduction in concrete disposal volume is possible. Because the depth of contamination will likely vary, scabbling will be performed in passes to assure complete removal, while concurrently minimizing disposal volumes. On-going scintillometer and gamma-ray spectroscopy surveys of activity levels within scabbled surfaces will provide data on the need for additional removal.

Following scabbling operations within each hot-spot area, the surface of concrete floors will be re-surveyed and samples analyzed to determine the presence of residual hot spots. If such areas are identified, additional scabbling will be performed, and the survey process repeated until the specified cleanup levels are achieved. An additional survey of each hot-spot will be performed when scabbling is complete to provide assurance that all residues are collected and that no airborne migration has influenced clean areas within the building. These surveys will be supported by an analytical testing program to verify complete removal of radioactive materials.

4.2.3 Structure Decontamination/Removal Options

There are several options for the decontamination or removal of structural building materials, piping, equipment, etc., if these materials are encountered at the Tenneco site above cleanup levels. The determination whether to dispose or decontaminate the materials will primarily be based on the practicality and cost of disposing the materials versus decontaminating them. Several options available for decontamination include:

- Rinsing affected ares with chemical reagent or acid wash and disposal of the cleaning fluid;
- Sand blast affected areas and dispose of materials removed; and
- Needle-point scabbling affected areas and disposal of removed residue.

4.2.4 Radioactive Material Storage

The radioactive material storage will vary depending on whether the materials are transported in Supersacks or bulk containers. **All radioactive materials removed from the outdoor areas, and from within indoor areas will be appropriately containerized and placed inside Building No. 31, which is directly adjacent to Building K-12 as shown on Figure 2. Temporary storage within this building will provide protection from the elements and will allow an adequate working area for staging or packaging prior to off-site disposal. As a precursor to the use of this building, a detailed walkover survey (3 meter square grid) detailing gamma exposure rates will be performed to establish that no radioactive impacts are present. Following the removal of radioactive materials from this building, a post-project screening program will be performed (3 meter square grid) to validate that no residual impacts are present that exceed applicable release criteria. If such impacts are noted, they will be remediated in accordance with other sections of this Work Plan.**

If the materials are transported in Supersacks, as the Supersacks are filled with contaminated concrete and soils, they will be closed and sealed by tying the laces on the Supersacks. Each Supersack will then be labeled to note the location of origin and outline the concentrations and types of radionuclides present. Once the filled Supersacks have been prepared for shipping they will be placed within a secure area for storage until ready for shipment. After a full truckload of Supersacks are prepared for shipment they will be loaded onto a flatbed trailer for transportation to the disposal facility. A log of all materials placed in storage will be kept, and will include the location of each container and information on the waste origin and concentration of materials within them.

If the materials are transported in bulk, the excavated materials will be transported to the designated storage area and placed on a geomembrane liner. The bulk storage area will be covered with a geomembrane liner to prevent precipitation from infiltrating into the excavated materials or the wind from spreading the contaminants. After sufficient quantity of material has been excavated for transport the material will be loaded into an end dump or rolloff container and covered with a good tarp for transportation to the disposal facility. A log of all materials placed in storage will be kept, and will include information on the waste origin and concentration of materials within them.

The secure area used for storage will be labeled as an off-limits area and will be locked to limit access. Materials within this area will be kept dry and secure until ready for loading and transport.

4.2.5 Radioactive Material Disposal

Radioactive materials exceeding specified cleanup levels will be shipped to the EnviroCare Facility in Clive, Utah, or other licensed facilities in Barnwell, South Carolina, Beatty, Nevada or Richland, Washington.

Shipments of radioactive materials will be performed as quickly as possible once all materials have been removed and packaged in accordance with Chem-Nuclear's requirements. These materials will then be manifested for transportation from the site in accordance with applicable Department of Transportation (DOT), EnviroCare, and State of Utah requirements. Once ready for acceptance at EnviroCare, the materials will be loaded onto the transporter and secured to meet appropriate requirements. These materials will then be shipped to the EnviroCare facility by a properly licensed and insured carrier.

4.2.6 Site Restoration

A significant consideration associated with the remediation program will be to restore the areas subject to material removal. Such restoration will be performed to allow, with respect to NRC guidelines, unrestricted future use of the facility with regard to the presence of radioactive materials.

4.3 TASK III - FINAL SITE VALIDATION SURVEY

Upon completion of remediation work activities and site restoration, a final site survey will be performed to verify that all radioactive materials, in excess of the allowable cleanup levels, have been removed. If appropriate, an assessment will also be made of the relationship of any residual concentrations to ALARA considerations. The format for the final site survey **has been developed using NUREG /CR-5849 criteria** and is outlined within the following sections.

As radioactive materials are removed, screened, and contained, exposure readings will be monitored to determine the likely point at which all radioactive materials have been removed. Once this point is reached, a statistically significant number of samples will be taken from within the limits of an established grid pattern that will be based on the dimensions of the removal area.

Samples obtained from the various locations will be subject to analysis by the on-site laboratory. The results of analytical determinations will then be subject to evaluation within each discrete area of removal. If additional radioactive materials are identified, removal operations will continue. If all radioactive materials have been removed to below background levels, or other established cleanup thresholds, then confirmatory samples will be obtained. These confirmatory samples will be subject to analysis in an off-site laboratory capable of providing high-purity germanium spectrometry. **It is presently anticipated that a total of 15-samples will be obtained for off-site analysis, although the total number of samples may increase based on the actual field conditions.** The frequency of sampling and QA/QC considerations for these samples were discussed previously. The results of these analyses will provide final confirmation that all radioactive materials have been removed to meet the applicable cleanup criteria.

The location and results of all screening and sample analysis will be compiled in a computerized project data base and located on scale drawings of the removal areas.

4.3.1 Open Land Surveys

Open land surveys within affected areas, as identified in the preliminary investigation or during the course of remediation, that have been remediated will be surveyed to verify compliance with acceptable gamma exposure rate readings and verify that radionuclide concentrations in the soils are below acceptable concentrations. Procedures for the gamma exposure rate survey are provided in Section 3.8 of this report. For affected areas, 100 percent coverage is required for the survey. After gamma exposure rate readings on a 1 meter grid indicate that the guidelines have been met, systematic soil sampling will be performed.

The samples obtained within the 1-meter square grid will be used to determine the concentration of remaining activity and identify the remaining horizontal and vertical extent of such impacts. Accordingly, samples will be obtained using a random distribution at the appropriate frequency using guidance from NUREG /CR-5849. This will provide for samples within areas exhibiting residual activity as well as those exhibiting no activity. Within selected locations of each removal area, soils samples will also be obtained from the surface down to the groundwater level to identify the concentration profile. While samples will be obtained from within areas exhibiting low gamma exposure rates, an emphasis will be placed on validating that areas with the highest gamma exposure rate readings are below the cleanup levels. A minimum of 15 samples will be collected from within the affected area for laboratory analysis. Specific material sampling and analysis procedures are outlined in Section 3.9 of this Work Plan.

For unaffected areas, the results of the gamma exposure rate survey conducted as part of Task I will be used for the validation survey. Soil sampling will be performed at a minimum of 30 randomly selected locations for the remainder of the facility.

4.3.2 Structure Surveys

Structure surveys within affected areas, building K-12 and the Third Converter building, as identified in the preliminary investigation, that have been remediated will be surveyed to verify compliance with acceptable gamma exposure rate readings and verify that surface activity on structure and debris surfaces are below acceptable levels. For affected areas, 100 percent coverage is required for the survey. A gamma exposure rate scan on a 1 meter grid of the structure walls and floor indicate that the guidelines have been met, wipe sampling is performed. Areas with the highest gamma exposure rate readings will be sampled for analysis at an approved off-site laboratory. A minimum of 30 wipe samples will be collected from within the affected area for laboratory analysis. Procedures for collecting wipe samples are provided in Section 3.9 of this Work Plan.

For unaffected areas, the results of the gamma exposure rate survey conducted as part of Task I will be used for the validation survey. Wipe samples will not be collected from unaffected areas unless the surface scan provides reason to suspect surface contamination above acceptable activity levels.

4.3.3 Groundwater and Subsurface Sampling

Groundwater and subsurface soil sampling are not anticipated for this site, however, if radionuclides are encountered down to the shallow ground water, groundwater and subsurface soil sampling may be required as part of the Final Validation Survey. Procedures for subsurface soil and groundwater sampling, if required, are provided in Section 3.9.

4.4 TASK IV - FINAL REPORT

Once project work and the final site survey has been completed, a comprehensive project documentation report will be prepared. This report will contain a summary of all work performed, and will be structured to facilitate review by the NRC. This report will provide the data necessary to support the position for release of the site to unrestricted use with regard to NRC guidelines on the presence of radioactive materials. **As such, the final report will include all final survey data from removal areas, as well as from storage or other materials handling locations.** The primary information provided within the report will include the following:

- Background of the facility including reason for decommissioning and management approach;
- Site description including type and location of facility, ownership, and facility description;
- Operating history including licensing, processes performed, and waste disposal practices;
- Decommissioning activities including results of previous surveys and decontamination/removal procedures;

- Final survey procedures including sampling parameters, background levels, major contaminants identified, guidelines established, equipment and procedures selected and surveying procedures;
- Survey findings including techniques for reducing/evaluating data and comparison of findings with guideline values and conditions; and
- A summary of the entire program.

5.0 PROJECT SCHEDULE

The proposed schedule for the remediation of radioactive materials at the Tenneco facility in Fords, New Jersey is presented in Figure 3. This schedule is based on the affected areas delineated during *SECOR*'s preliminary investigation and estimated quantities described in Section 2.0 of this report. If the affected areas or quantities of material significantly differ from those estimated, the schedule will be impacted.

A detailed schedule will be maintained and updated during the course of the remediation to reflect work which has been completed and changes to the overall project schedule and duration. These schedule updates will be provided to the regulatory agencies with the monthly project tracking updates.

6.0 SITE HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP), Appendix A, provides guidance and establishes procedures for site remediation activities proposed for the former Tenneco Polymers, Inc. facility in Ford, New Jersey. The procedures and guidelines set forth will be used to identify and minimize hazards to human health or the environment while performing duties at this site. Historical data as well as site reconnaissance, were used to develop protocols for required personal protective equipment during entry, sampling, remediation and decontamination procedures.

This project specifically involves the excavation, removal and disposal of soils affected by Uranium-238 and its daughter products and Radium-226 and its daughter products. *SECOR* shall use the HASP as one tool to provide radiological support to personnel working on-site. Primarily, this involves the identification of monitoring levels, protocols and action levels by the which the assigned Site Health and Safety Officer will regulate the ongoing work at the site.

TABLES

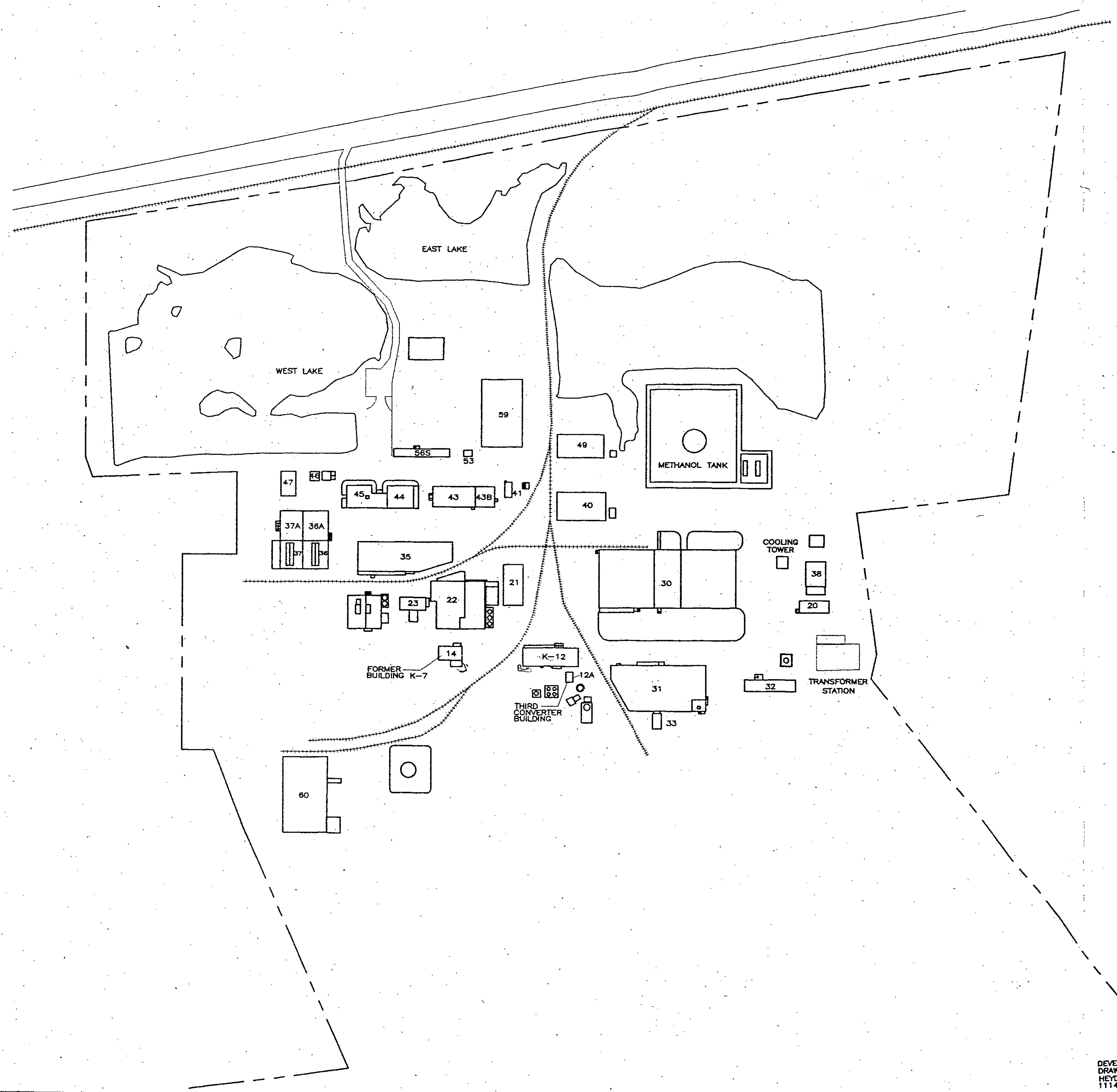
TABLE 1

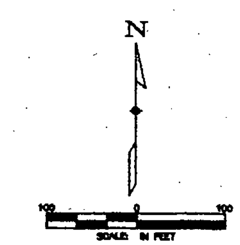
ANALYTICAL RESULTS FOR SOIL AND SEDIMENT SAMPLES
PRELIMINARY FIELD INVESTIGATION
FORMER TENNECO POLYMERS INC. FACILITY
FORDS, NEW JERSEY

Nuclide	Units	Sample Location				
		001 Third Converter 6" depth	002 Third Converter 12" depth	003 Southwest corner of Building K-12	004 East end of Building K-12 floor trench	005 West end of Building K-12 floor trench
Cs-134	pCi/g	<.083	<.11	<.29	<.11	<.16
Cs-137	pCi/g	.21	<.12	<.31	.20	<.17
Zn-65	pCi/g	<.13	<.13	<.28	<.14	<.18
Co-60	pCi/g	<.039	<.040	<.091	.058	<.052
Ra-226	pCi/g	.28	.31	.79	.022	<.21
Fe-59	pCi/g	.11	<.099	.26	<.10	<.16
Th-232	pCi/g	.31	<.19	.57	.42	<.26
Mn-54	pCi/g	<.066	<.084	.32	<.079	<.11
Zr-95	pCi/g	<.18	<.21	<.60	<.22	<.31
U-238	pCi/g	250	580	5000	340	1200

FIGURES

NO.	DATE	INIT.	REVISION





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SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

PREPARED BY:

SECOR INTERNATIONAL INCORPORATED

SECOR

355 UNION BOULEVARD
SUITE 200
LAKEWOOD, COLORADO 80228

PREPARED FOR:

TENNECO, INC.
HOUSTON, TEXAS

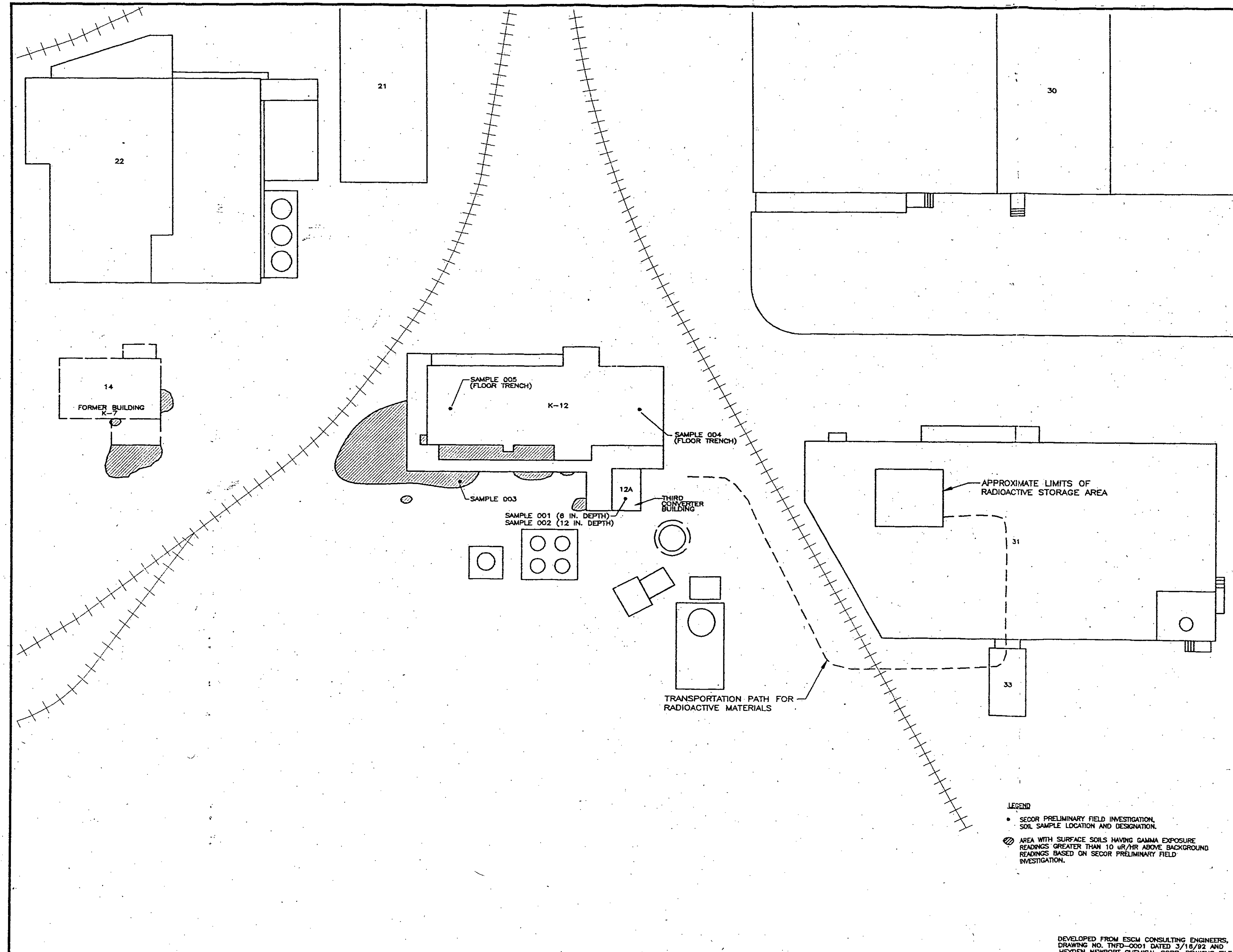
FORDS, NEW JERSEY SITE

SITE PLAN

DESIGNED BY:	DETAILED BY:	CHECKED BY:
T KREUTZ	SBL	

DATE:	ACAD FILE:
07/25/95	BAS=0011
PROJECT NO.:	**PLOT SCALE:**
B0136-001-01	1" = 100'

Figure 1



NO.	DATE	INIT.	REVISION

SIGNATURE	DATE
REVIEW ENGR:	
PROJECT ENGR:	
PROJECT MGR:	
CLIENT:	

PREPARED BY:

SECOR INTERNATIONAL INCORPORATED

SECOR

365 UNION BOULEVARD
SUITE 200
LAKEWOOD, COLORADO 80228

PREPARED FOR:

TENNECO, INC.
HOUSTON, TEXAS

FORDS, NEW JERSEY SITE

RESULTS OF SECOR
PRELIMINARY FIELD
INVESTIGATION

DESIGNED BY:	DETAILED BY:	CHECKED BY:
T KREUTZ	SBL	

DATE:	ACAD FILE:
08/29/96	BAS-0027
PROJECT NO.:	PLOT SCALE:
B0136-001-01	1" = 20'

Figure 2

APPENDIX A

APPENDIX A

HEALTH AND SAFETY PLAN

Tenneco Polymers Facility
Fords, New Jersey

Tenneco Incorporated
P.O. Box 2511
Houston, Texas 77252-2511

Submitted by:
SECOR **International Incorporated (*SECOR*)**
355 Union Boulevard, Suite 200
Lakewood, Colorado 80228

September 5, 1996

SECOR Project No. B0136-001-01

Rev. 01-30-95

SECOR
HEALTH AND SAFETY PLAN
REVIEW AND APPROVAL

CLIENT: Tenneco Incorporated

SITE NAME: Former Tenneco Polymers, Inc. Site

PROJECT NAME: Tenneco Polymers, Inc.

PROJECT NUMBER: B0136-001-01

START DATE: October 1, 1996 (tentative date)

END DATE: December 31, 1996

PLAN EXPIRATION DATE: April 1, 1997
(Last day of expected field work or no longer than 6 months).

Elizabeth A. Cost. Plan Completed By	Signature	Date
Project Manager/Health & Safety Officer	Signature	Date
Site Health and Safety Coordinator	Signature	Date
Dale W. Evans, P.E. Principal-in-Charge	Signature	Date
Jim Johnson, PhD. CHP Subcontractor - Certified Health Physicist	Signature	Date
Elizabeth A. Cost Industrial Hygienist or Safety Professional	Signature	Date

This Health and Safety Plan has been written for the use of *SECOR* and its employees. It may also be used as a guidance document by properly trained and experienced *SECOR* subcontractors. However, *SECOR* does not guarantee the health or safety of any person entering this site.

Due to the potential hazardous nature of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this Plan were prepared specifically for this site and should not be used on any other site without prior research by trained health and safety specialists.

SECOR claims no responsibility for its use by others. The Plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if these conditions change.

TABLE OF CONTENTS

LIST OF ATTACHMENTS

I. GENERAL SITE REQUIREMENTS AND BACKGROUND INFORMATION

A. Health and Safety Plan Responsibilities

- Prior to beginning on-site work, the Project Manager will ensure Attachments 1-6 are completed.
- The Site Health and Safety Officer will ensure Attachments 7-10 are completed the first day of on-site work.
- The Site Health and Safety Officer will implement the Plan. He/she has the authority to stop work or prohibit any personnel from working on the site at any time for not complying with any aspect of the Plan.
- The Subcontractor Field Supervisors are directly responsible for implementing the Plan for his/her own employees.
- Each person on the site has responsibility for their own health and safety, as well as assisting others in carrying out the Plan. Any person observed to be in violation of the Plan should be assisted in complying with the Plan, or reported to the Site Health and Safety Officer or the Subcontractor Field Supervisors.
- Any site personnel may shut down field activities if there is a real or perceived immediate danger to life or health.

B. Site Health & Safety Officer Responsibilities

- The Site Health & Safety Officer will be responsible for screening all work areas for chemical, radioactive or mixed waste influences for the purposes of identifying work zones, levels of protection required, and any unique hazards.
- Once work zones are established but prior to commencing work, the hazards within each area and particular concerns will be reviewed by the Site Health & Safety Officer with the workers.
- All field operations within impacted areas will be subject to direct oversight by the Site Health & Safety Officer.
- The Site Health & Safety Officer will perform all personnel monitoring for work associated with radioactive materials.
- TheSite Health & Safety Officer will ensure that all documentation is properly updated and maintained on a daily basis.

C. Minimum Training and Medical Surveillance Requirements for Site Personnel

- 40 hr. Health and Safety Training for hazardous waste workers
- 8 hr. Annual Refresher Training
- 8 hr. Supervisor Training for Site Health and Safety Officer
- Respirator Fit Testing
- Prior Occupational Radiation Dose Form
- 8 hr. Radiation Control Procedures Course
- Whole Body Count as Determined by Subcontractor Health Physicist
- Annual Medical Surveillance

D. Utility Clearance: NA

1. To be performed by:

2. Date to be performed:

E. Initial Site Entry: Has this been performed by *SECOR*? (YES/NO): YES If YES, describe:

A site visit was performed by SECOR personnel to evaluate the site and its access as well as other logistical issues.

F. Purpose of Field Work:

To remediate low-level radioactive materials from the surface soils at the Tenneco, Inc. site located in Ford, New Jersey. To validate remedial activities, confirmation sampling will be conducted in accordance with NRC guidelines.

G. Detailed Description of Specific Tasks Planned (Number each separate task in order of progression. The task numbers assigned here will be referred to throughout the Plan):

1. Work Area Set-up - A work area boundary/exclusion zone will be identified by temporary fencing. The property boundary/site boundary is identified by a permanent fence with a gate at the front and rear entrances to the facility.

2. Facility reconnaissance - The only underground utility remaining at this out-of-use facility is a fire protection water line. The location of this line will be marked. Initial cleanup boundaries (the affected area) will be established by outlining a 5 meter gridded area. This grid will be established using a gamma scintillometer. By this method all areas requiring cleanup will be captured within the gridded area.

3. Remedial Surface Excavation - Locations within the gridded area shall be excavated until soil is below 35 pCi/g of U-238, by gamma spectroscopy. The entire affected area will be excavated (cleaned) by this method. A front end loader or similar piece of heavy machinery will be used to perform surficial excavations. Decontamination procedures are described in section V-Health and Safety Procedures, Part D. Disposal of affected and removed soil will be performed by hauling soils via NRC/DOT permit to a radionuclide disposal facility according to disposal facility site permit.

4. Confirmation Sampling - One-hundred percent of the excavated area will be subgridded and confirmation sampled by gamma spectroscopy. A grab sample from soils at 0-4 inches below cleaned areas will be collected. A trowel will be used to collect confirmation samples. If all samples from each subgrid confirm cleanup below identified target levels, then verification sampling will take place. Further cleanup will be performed on any residually affected area.

5. Verification Sampling - A random batch of samples will be collected from the cleaned area. This sample batch will provide a statistical evaluation of the confirmation sampling. Samples will be collected by the same method employed during confirmation sampling.

6. General Gamma Survey - A walking gamma survey of the entire site will be performed to further confirm cleanup of identified areas as well as provide confirmation of identified unaffected areas.

H. Excavation and Trenching

Excavation and/or trenching will be done on this site? (YES/NO): YES If YES, describe including proposed dimensions and if entry may be required (including mounting tanks for vacuuming, purging, sampling, etc.):

Scope of work calls for the surficial excavation of areas affected by radionuclides. The final boundaries of these excavations will be determined by confirmation sampling. The total area of excavated soil is estimated to be 100 cubic yards.

I. Landfills and Other Areas Potentially Containing Explosive Gas or Vapor

Site is in an area containing a current/former landfill, or the geology contains known/suspected pockets of explosive gas/vapor? (YES/NO): NO If YES, describe:

N/A

J. Time of On-Site Work

Work will be done during daylight hours? (Yes/No): YES If NO, describe: N/A

K. Hazardous Materials

Will any hazardous materials (chemicals) be used on site? (If so, MSDS's will have to be attached to the Plan) YES/NO: NO If YES, describe: N/A

L. Background Information (e.g. historical and continuing operations or adjacent site contamination):

Site is the historical location of the Tenneco Polymers, Inc. facility. Through various facility processes Uranium-238 and Radium-226 have been introduced into surficial soils at low levels. The affected area is the area surrounding three buildings formerly involved in the processing of 200-400 pounds of Uranyl Nitrate per year. Two of these buildings remain on-site.

M. Site Communication and Authority

All personnel working at the site will follow the requirements of this Health and Safety Plan. These activities will be performed with the primary emphasis on safety and as such, the Site Health & Safety Officer will make all determinations regarding risk. Therefore, communication of potential risks will be made from workers to the Site Health & Safety Officer and a determination made as to the methods used to continue work.

During the progress of work, communications between field personnel and Tenneco management will occur on a daily basis. Any irregularities, unforeseen conditions, or other potential problems will be communicated at such time.

II. SITE CHARACTERISTICS

A. Facility Description (Identify structures, buildings, pits, impoundments, and work area.):

The Tenneco Polymers, Inc site is located in an industrial area adjacent to the north shore of Raritan River. The facility consists of numerous abandoned buildings remaining on the northern one-third of the site. The southern two-thirds of the site is covered by wetlands vegetation. No industrial or manufacturing processes have been performed on this portion of the property. Three lakes are located on the northern third of the property. The affected area is the area surrounding three buildings formerly involved in the processing of 200-400 pounds of Uranyl Nitrate per year. Two of these buildings remain on-site. the entire site is surrounded by chain-link perimeter fencing. One gate is located on the northern boundary of the site to provide the only means of access and egress for the site.

B. Site Status:

Occupied (YES/NO): NO If YES, describe current activities:

C. Unusual Site Features (water supply, telephone, radio, powerlines, traffic patterns, gas lines, water mains, terrain, vacant lots, debris, other physical hazards, etc.):

The fire protection water line is the only subsurface utility that has been identified on-site. Overhead powerlines are present on-site. Debris associated with an abandoned facility can be expected.

D. Site Map (See Attachment 4 - include adjacent buildings, encumbrances, site facility, previous project location (if any), proposed project location, and location of nearest phone.)

E. Contaminant Description (Maximum concentrations):

Radionuclide	Source of Contamination	Source of Sample (soil)	Sample Concentration	Environmental Regulatory Action Level
U-238	Tenneco Polymers, Inc. use of facility in processing Uranyl Nitrate	NRC, et. al., historical soil sampling	7210 pCi/g	NRC Guideline 35 pCi/g
Ra-226	"	"		NRC Guideline 5 pCi/g

Reference:
SECOR's Work Plan for Radioactive Materials Remediation and Site Screening drafted July 24, 1995.

III. WASTE CHARACTERISTICS

A. **Waste Generation** (Type(s)/Quantities Expected):

Anticipated (YES/NO): yes

Types: Liquid x Solid x Sludge ____ Other (describe)____

Quantity (Expected Volume): Approximately 100 cubic yards.

B. **Characteristics** (Expected):

Corrosive ___ Flammable/Ignitable __ Radioactive x Toxic __ Reactive ___ Unknown ___
Other (specify) ____

C. **Packaging Requirements for Waste Material** (Expected):

- open head 55-gallon drum ____
- closed head 55-gallon drum ____
- overpack drum ____
- baker tanks ____
- lined waste bins x (directly loaded into container for transportation)
- other possibly use supersacks (1 cubic yard container system)

D. **Disposal and/or Treatment Methods Proposed:**

Solid waste (soil) to be characterized and disposed of at Envirocare facility in Utah. Waste to be coordinated for shipment by *SECOR*. Tenneco will be named as shipper of waste.

SECOR will be responsible for characterizing, packaging, labeling and on-site storage of suspected or known waste.

IV. TASK SPECIFIC HEALTH AND SAFETY RISK ANALYSIS

A. Predominant Potential Site Chemical Hazards

CHEMICAL (OR CLASS)	(MPD) (units mrm/year) PEL/TLV	OTHER PERTINENT LIMITS	WARNING PROPERTIES	ROUTES OF EXPOSURE OR IRRITATION	ACUTE HEALTH EFFECTS	CHRONIC HEALTH EFFECTS/ TARGET ORGANS
Alpha, Beta, Gamma emissions	2,000 mrm/year (TEVE)	IDLH = 10 mg/m^3	None - specific	Inh, Ing, Con, Skin	Nausea; vomiting; skin redness	Carcinogen (lung), blood, liver, kidneys
Benzaldehyde	100 ppm	flash pt. 148°F	colorless liq. with a burning taste with bitter almond odor	Ing, Inh	dizziness, skin irritation	CNS, skin

MPD(mrm) = Maximum Permissible Dose Rate Limit
PEL = Permissible Exposure Limit
TLV = Threshold Limit Value
Skin = Skin absorption can be a significant part of exposure
STEL = Short Term Exposure Limit
IDLH = Immediately Dangerous to Life or Health
CNS = Central Nervous System

B. Potential Non-chemical Hazards

	YES	NO
Overhead/underground hazards	x	
•Overhead (describe)	x (powerlines)	
•Underground (describe)	x (utilities)	
Equipment hazards		
•Drilling		x
•Excavation	x	
•Machinery	x	
Heat exposure	x	
Cold exposure		x
Oxygen deficiency		x
Confined space		x
Noise	x	
Ionizing radiation	x	
Non-ionizing radiation		x
Fire/Explosion		x
Biological		x
Safety		
●Holes/ditches	x	
●Steep grades	x	
●Slippery surfaces	x	
●Uneven terrain	x	
●Unstable surfaces	x	
●Elevated work surfaces		x
Shoring/Scaffolding		x
Other:		x

C. Task Specific Hazards:

	TASK	HAZARD RATING	IDENTIFIED/ ANTICIPATED HAZARDS
1.	Work Area Set-up	moderate	trip/fall, radiation
2.	Facility Reconnaissance	moderate	trip/fall, radiation
3.	Remedial Surface Excavation	moderate	heavy machinery, radiation, noise
4.	Confirmation Sampling	low	potential residual radiation
5.	Verification Sampling	low	potential residual radiation
6.	General Gamma Survey	low	potential residual radiation

D. Overall Hazard Rating (Unknown, low, moderate, serious, or extreme):

moderate

V. SITE HEALTH AND SAFETY PROCEDURES

A. **MAPS - Site Map and Hospital Location Map** (Attachments 4 & 6, respectively): Hospital route must be clearly marked. POST SITE AND HOSPITAL LOCATION MAPS.

B. **Site Security:** Site Health and Safety Officer is responsible for preventing unauthorized entry onto the site and for knowing who is on site at all times.

1. Work will be done around heavy equipment (e.g. drill rig, backhoe, etc.) (YES/NO): YES
   If YES, describe: Surface excavations performed by heavy machinery (e.g. backhoe)
2. Work will be done in or adjacent to a road, street or highway (YES/NO): NO

   If YES, describe: N/A
3. Prior to working on-site, a general inspection for hazards will be made by the Site Health and Safety Officer.

4. Access to the work site will be controlled in the following manner:

   - Work site area perimeter identification method (describe equipment and procedures to be used):

     Permanent or temporary fencing, will be utilized to identify the following area perimeters: 1. Property boundary fence - chain-link fencing with security gate at the north end of facility. 2. Work area perimeters will be temporary fenced around affected area.

   - Work area security (on and off-hours):

     Security personnel, off hours, and temporary fencing, described above, will be used around excavations, equipment and other areas with potential hazard. The entire grounds will be secured within the property perimeter fencing and security gate.

5. If an on-site command post is necessary, ensure that it is located upwind from sources, give prevailing winds, and locate/identify on Site Map (Attachment 4).

6. On-site personnel must be able to call off-site via a telephone within 150 feet of work.

7. Post emergency telephone numbers (Attachment 1).

8. Designate at least one vehicle for emergency use.

C. Work Limitations and Restrictions:

- No eating, drinking, or smoking on-site.
- No contact lenses on-site. Workers requiring vision correction must wear glasses in environments with chemicals.
- No facial hair that would interfere with respirator fit.
- Buddy system at all times in Level 'C' or 'B', or when working around heavy equipment like backhoes or drill rigs.
- Radiation Control
  - Exposure rates as high as 350 μR/hr have been detected in previous surveys. Since there are presumed to be "Hot Spots," times at these locations will be minimal, i.e., less than one hour. No external dose or internal committed dose above 25 mrem (PDL) is expected during the entire cleanup. The 10CFR-20 limit for radiation worker dose is 5,000 mrem/2,000 hr year or 2.5 mrem/hr. However, an upper working limit for this site was chosen to be 1.0 mrm/hr. All workers will wear personal TLD dosimeters CaF_2 (Dy) and will not enter any area before the exposure rate is determined (and logged) using the scintillation survey meter described below.
  - Inhalation

    Activities that will generate dust aerosols containing radioactive materials are not anticipated due to controls that will be used. However, in the event that such potential does exist, process or engineering controls will be employed as outlined in 10CFR 20.1701. If such controls are not sufficient to mitigate airborne migration, individual respiratory equipment will be used as outlined in 10CRF 20.1703.

    Under such circumstances workers will wear NIOSH/MSHA certified respirators with the appropriate cartridges. Air samples, within worker breathing zones will be taken as necessary to determine worker exposures.
  - Ingestion

    Workers will wear protective clothing as specified in Section 4.3.1. They have been instructed to refrain from eating, smoking, etc., until hands have been cleaned and surveyed for contamination. Ingestion intake is of low probability, if good work habits are followed. On-the-job wounds will be immediately treated and decontaminated if necessary. Bioassay by whole-body counting will be conducted at the Colorado State University gamma-ray spectroscopy laboratory at the beginning and end of the clean-up work or during the project if accident conditions dictate.
  - Personnel Protection

    All workers on site have received an 8-hour radiation protection short course conducted by J.E. Johnson Ph.D., Certified Health Physicist. (See attached course outline.) Dr. Johnson will be on site for additional on-the-job training and supervision throughout most of the cleanup.

All workers will wear protective clothing to prevent spread of contamination. The clothing will be monitored frequently using an end-window G-M or ZnS (Ag) Alpha survey meter and bagged for disposal if found to be contaminated greater than three standard deviations above mean background.

Field monitoring instrumentation will be:

NaI scintillation survey meter (Ludlum Model 19 microroentgen meter). This meter is calibrated for exposure rates by standard sources traceable to NIST.

End-window G-M survey meter (Ludlum Model 16). This will be used for contamination control and is capable of detection of the beta particles.

ZnS (Ag) Alpha Scintillation Survey Meter

Laboratory Gamma-Ray Spectrometer consisting of 25 percent efficiency Germanium (Ge) detection crystal container in a lead and concrete shield will be used to count soil samples, concrete chips, protective equipment, etc. This equipment will be housed on the site and used to make decisions on the extent of progress of cleanup. All samples to be counted will be dried, homogenized and packed to constant density in one quart paint cans for counting. This system has been calibrated with cans containing reference materials traceable to NIST.

Final documentation of the cleanup will be by Germanium (Ge) gamma-ray spectrometry of soil and concrete samples counted at an approved laboratory. The laboratory will have an active QA program and participate in the EPA cross check program.

- Heat and Cold Stress
  - The Site Health and Safety Officer will monitor weather broadcasts before the start of outdoor work each day, and more frequently as necessary. No work will be done outdoors in inclement weather (rain, snow, sleet, etc.) without authorization from Corporate Health and Safety.
  - Heat Stress
    - For temperatures above 70°F, each person will take their pulse at rest. At breaks, the pulse should be less than 110 beats per minute after one minute. Before returning to work, the pulse should be no more than 10 beats greater than the resting pulse.
    - If the air temperature is greater than 95°F, work should be done for 30 minutes with a rest break of 10 minutes for Level D. For Level C, work should be done for 20 minutes with a rest break of 10 minutes.At least 8 ounces (1 cup) of cool water, Gatorade-type drink, or dilute fruit juice should be consumed at each rest break or at least one cup every 20 minutes.
    - Work should stop if any of the following symptoms occur: muscle spasm and/or pain in the limbs or abdomen (heat cramps); weak pulse, heavy sweating, dizziness, and/or fatigue (heat exhaustion); or rapid pulse, no sweating, nausea, dizziness, and/or confusion (heat stroke). Provide First Aid immediately.

- Use sunscreen on unprotected skin to protect against ultraviolet exposure.

- Cold Stress

  - For temperatures below 40°F, adequate insulating clothing must be worn. If the temperature is below 20°F, workers will be allowed to enter a heated shelter at regular intervals. Warm, sweet drinks should be available. Coffee intake should be limited.

    No one should begin work or return to work from a heated shelter with wet clothes. Workers should be aware of signs of cold stress, including heavy shivering, pain in the fingers, drowsiness, irritability, or euphoria ("feeling high"). Onset of any of these signs are indications for immediate return to a heated shelter.

D. Decontamination Procedures:

1. Personnel:

   Soap & Water

2. Sampling Apparatus:

   Soap & Water (Alconox or equivalent)

3. Heavy Equipment:

   High pressure washer

4. Level 'C' Decontamination Stations (in order from exclusion zone to support zone):

   a) Equipment drop
   b) Wash and rinse outer garment, boots, and gloves
   c) Remove outer boots and gloves
   d) Change respirator cartridges (if returning to exclusion zone)
   e) Remove inner gloves and outer garment
   f) Remove respirator
   g) Clean hands and face
   h) Survey personnel using Model 19 meter to check for "clean" level
   i) Leave coveralls, outer clothing on-site

E. General Procedures:

- The Utility Clearance Log (Attachment 5) will be completed prior to beginning any subsurface work.

- Determine wind direction, establish exclusion zone, and set up decontamination reduction zone and support zone upwind when upgrading to Level 'C' or 'B'.

- Try to remain upwind when collecting samples, venting wells, etc.

- Daily Health and Safety Briefings will be held by the Site Health and Safety Coordinator (Attachment 9). The first Briefing will include, at a minimum, information in Sections V and VI.

- Potable water must always be available at the work site.

- If toilet facilities are not located within a 5-minute walk from the decontamination facilities, either provide a chemical toilet and hand washing facilities or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.

- Provide dust control by spraying soils with water.

- Use ground fault circuit interrupters for plug-in electrical devices and extension cords (3-pin plugs only).

- Be aware of tripping hazards with extension cords, tools, hoses, augers, etc.

- Other:____
____

F. Perimeter Identification:

Complete the table below indicating the type of zone boundaries required for this job. Mark zone boundaries on Site Map, Attachment 4.

TASK NO.[1]	ZONE BOUNDARIES REQUIRED[2,4]	LEVEL OF PROTECTION REQUIRED FOR EACH ZONE[3,4]
1	c(a-c)	D(C)
2	d(a-c)	D(C)
3	d(a-c)	D(C)
4	d(a-c)	D(C)
5	d(a-c)	D(C)
6	d(a-c)	D(C)
7	d(a-c)	D(C)
8	d(a-c)	D(C)

---

[1]As identified in Section I, Subpart E.

[2]This job will require one or all of the following "zones" or "boundaries" to be established during work.

a. Exclusion Zone - Required when workers within that zone must wear personal protective equipment (PPE).

b. Contamination Reduction Zone - Required when decontamination of people and equipment leaving the Exclusion Zone is required.

c. Support Zone - the location where administrative and other support activities are conducted.

d. Work Area Boundary - Excludes non-workers from entering a potentially hazardous environment.

[3] Level A - Self-contained breathing apparatus (SCBA), totally encapsulating suit, two-way radio communications.

Level B - SCBA or supplied-air respirator with an escape bottle, chemically resistant PPE, two-way radio communications.

Level C - Full- or half-face air-purifying respirator (with safety goggles), chemically resistant PPE.

Level D - No respiratory protection. Safety glasses, hard hat, steel-toe boots, long-sleeved shirt and pants. Hearing protection, gloves, and other PPE as required.

[4]If Level C, B, or A is used per Section E, Personal Protective Equipment, zone boundaries must include zones a-d.

G. Personal Protective Equipment Requirements:

Level 'D'mod.: safety glasses, hard hat, disposable ear plugs, steel-toe boots. For contact with moist soil or liquid:

Gloves Nitrile

Boot covers PVC

Coverall suit Cotton coverall to be worn preventing dust and aereosol contamination of clothing

Level 'C': Level 'D' modified as above plus respiratory PPE described below.

Respirator Half mask respirator with HEPA cartridge

Gloves Nitrile - outer

Boot covers PVC steel toe

Coveralls Cotton

TASK NO.	LEVEL OF PROTECTION	UPGRADED LEVEL OF PROTECTION
1	D mod	N/A
2	D mod	C
3	D mod	C
4	D mod	C
5	D mod	C
6	D mod	C

H. Safety Equipment and Supplies Requirements:

-reflective vests to be worn around moving vehicles, if any,

-at least one ABC-type fire extinguisher,

-First Aid Kit,

-emergency eyewash (enough solution for 15 minutes of cleansing),

-2-Hudson-type sprayers for decontamination (TSP/detergent solution and H_2O rinse),

-hearing protection in the form of disposable ear plugs to be worn around heavy equipment, machinery, or when two individuals five feet or less apart need to shout to be heard,

-soap gel or disposable wipes,

-disposable towels,

-plastic sheeting,

-cleaning brushes and tubs.

I. Air Monitoring Equipment Requirements (to be conducted by Site Health and Safety Officer, Attachment 8).

		TASK NO'S.	GENERAL MONITORING FREQUENCY*
1.	Direct Reading Instruments: ●Manufacturer- Ludlum Instr. ●Model- 19 - Gamma Scintillator ●Probe- NaI	all	See Section K
2.	Personal TLD Badges CaF^2 (Dy)	all	
3.	Personal exposure monitoring: ● MIE - Mini Ram Aerosol Monitor-PDM-3	all	See Section K
4.	Calorimetric tubes:		
5.	Other equipment:		

J. Air Monitoring Equipment Calibration/Check Requirements (to be conducted by Site Health and Safety Officer, Attachment 7).

		FREQUENCY*
1.	Direct reading instruments: ● Ludlum Model 19	Source Check twice daily
2.	Personal exposure monitoring: ● Mini Ram aerosol monitor	Battery check and visual check each day
3.	Calorimetric tubes:	
4.	Other equipment:	

* See Section K, Action Level Table for Chemical Monitoring for details. Additional monitoring should begin immediately <u>if the operation destabilizes, the environment changes, or the potential for exposure is otherwise affected</u>.

K. Action Level Table for Chemical Monitoring

CHEMICAL (OR CLASS)	MONITORING EQUIPMENT	TASK NO.	MONITORING FREQUENCY/ LOCATION	LEVEL FOR RESPIRATOR USE	LEVEL FOR WORK STOPPAGE
radionuclide emissions	Ludlum Model 19 Gamma Scintillometer	all	continuous		10 mrm in any one day
dusts or aerosols	MIE Mini Ram Aerosol Monitor	all	continuous		5.0 mg/m^3

VI. CONTINGENCY PLAN

A. **Injury or Illness:**

If an injury or illness occurs, take the following action:

- Get First Aid for the person immediately.
- Notify the Site Health and Safety Officer. The Site Health and Safety Officer is responsible for preparing and submitting the Injury/Illness Incident Report to the Health and Safety Director within 24 hours, as well as notifying the employee's supervisor and Principal-in-Charge.
- The Site Health and Safety Officer will assume charge during a medical emergency.

B. **Local Emergency and Project Telephone Numbers** (See Attachment 1)

C. **Emergency Routes** (Also see Hospital Location Map - Attachment 6):

- Route from on-site work area to off-site property: Exit property to ______________________

- Route from off-site property to hospital: ______________________

ATTACHMENT 1

SECOR

LOCAL EMERGENCY AND PROJECT TELEPHONE NUMBERS

LOCAL EMERGENCY NUMBERS: To be finalized before start of project.

	NAME	EMERGENCY TELEPHONE NO.	BACKUP TELEPHONE NO.
Hospital			
Ambulance	Ambulance Company	911	
Police/Sheriff	Ford Police Dept.	911	
Fire	Ford Fire Dept.	911	
Other:			

PROJECT PERSONNEL NUMBERS: To be finalized before start of project.

	NAME	TELEPHONE NO.
Site Health and Safety Officer		
Project Manager		
Principal-in-Charge	Dale W. Evans	303-763-8800
Site Contact		
Client Contact		
Field Health and Safety Manager	James E. Johnson	970-241-5913
Health and Safety Coordinator	Elizabeth A. Cost	303-763-8800
Human Resources Director	Marguerite Agrella	619-658-7472

GOVERNMENTAL CONTACT NUMBERS:

INSTITUTE	NAME	TELEPHONE NO.
NRC		301-492-7000
NJDEP		609-292-8341
Region 2 EPA		212-264-8356
Other: OSHA - Avenel, NJ		908-750-3270

ATTACHMENT 2

SECOR

EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE*

Responsibility	Name	Certification Dates					
		OSHA 40-Hour	OSHA 8-Hour Refresher	OSHA 8-Hour Supervisor	First Aid/ CPR	Medical Clearance	8-hour Radiation Safety
Site Health and Safety Officer							
Alternate Site Health and Safety Officer							
Other field staff							
Other field staff							
Other field staff							
Other Field Staff							
______________ will be notified prior to the project involvement of others not shown herein.							

* To be finalized before start of field work.

ATTACHMENT 3

SECOR

SUBCONTRACTOR TRAINING AND MEDICAL SURVEILLANCE RECORD

Subcontractor:____

Address:____

Employees Assigned to Project:____

____

I certify the above employees assigned to this project have received training and medical surveillance according to the Health and Safety Plan and the Occupational Safety and Health Administration Standard on Hazardous Waste Operations and Emergency Response (29 CFR 1910.120):

______________________	______________________
Name	Signature
______________________	______________________
Title*	Date

*Subcontractor Field Supervisor or Manager only.

ATTACHMENT 5

SECOR

UTILITY CLEARANCE LOG

Date:____

"One-call" confirmation number and date contacted:________________________

"One-call" expiration date:____________________________________

Subcontractor locating firm and invoice number:__________________________

Facility contact person & telephone number:____________________________

Facility drawings reviewed:____________________________________

Verbal/written sign-off of clearance by facility contact:_______________________

Pressurized lines/shut-off valves identified:*___________________________

Underground utilities/lines identified:*____
____

Underground utilities/lines marked on-site by:___________________________
____

Overhead utilities/lines identified:*________________________________

Overhead utilities/marked on-site by:________________________________

*Mark on copy of facility drawing or include in site sketch. Maintain in project file.

Clearance contact:

__________________________________ __________________________

Name (*SECOR* employee only) Signature Date

Clearance reviewed by:

__________________________________ __________________________

Name (*SECOR* Project Manager) Signature Date

ATTACHMENT 7

SECOR

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG*

DATE	INSTRUMENT/ MODEL NO.	SERIAL NO.	BATTERY CHECK OK?	ZERO ADJUST OK?	CALIBRATION GAS (PPM)	READING (PPM)	LEAK CHECK	PERFORMED BY	COMMENTS

* Submit copies of logs to Corporate Health and Safety within 24 hours of expiration date of Plan, if a PEL is exceeded, or personal protective equipment level is upgraded.

ATTACHMENT 8

SECOR

AIR MONITORING LOG*

DATE	TIME	LOCATION	SOURCE/AREA/ BREATHING ZONE	INSTRUMENT	CONCENTRATION/UNITS	SAMPLED BY

* Submit copies of logs to Corporate Health and Safety within 24 hours of expiration date of Plan, if a PEL is exceeded, or personal protective equipment level is upgraded.

ATTACHMENT 9

SECOR

DAILY HEALTH AND SAFETY BRIEFING LOG

Date:____________________________

Start Time:_________________________

Issues Discussed:____

____

____

____

____

Print Name	Signature
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________
____________________________	____________________________

Attendees:

Meeting Conducted by:____

Name (Site Health and Safety Coordinator) Signature

ATTACHMENT 10

SECOR

HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT AND AGREEMENT FORM

(All *SECOR* and subcontractor personnel must sign.)

I acknowledge I have reviewed a copy of the Health and Safety Plan for this project, understand it, and agree to comply with all of its provisions. I also understand I could be prohibited by the Site Health and Safety Coordinator or other *SECOR* personnel from working on this project for not complying with any aspect of this Health and Safety Plan:

________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date
________________Name	________________ Signature	________________ Company	____________ Date

ATTACHMENT 11

SECOR

EXCAVATION INSPECTION LOG

Project Name:

Project Number:

Site Name: **Location of EX or ID:**

Client Name: **Client contact:**

Date/Time	Status of Excavation (OK/Not OK)	Comments	Reg. Eng. or Comp. person (initial)

ATTACHMENT 1

LOCAL EMERGENCY AND PROJECT TELEPHONE NUMBERS

ATTACHMENT 2

EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE RECORD

ATTACHMENT 3

SUBCONTRACTOR TRAINING AND MEDICAL SURVEILLANCE RECORD

ATTACHMENT 4

SITE MAP

(To be finalized before start of project)

ATTACHMENT 5

UTILITY CLEARANCE LOG

ATTACHMENT 6

HOSPITAL LOCATION MAP

(To be finalized before start of project)

ATTACHMENT 7

AIR MONITORING EQUIPMENT CALIBRATION/CHECK LOG

ATTACHMENT 8

AIR MONITORING LOG

ATTACHMENT 9

DAILY HEALTH AND SAFETY BRIEFING LOG

ATTACHMENT 10

ACKNOWLEDGEMENT AND AGREEMENT FORM

ATTACHMENT 11

EXCAVATION INSPECTION LOG

ATTACHMENT 12

RADIATION CONTROL TRAINING COURSE

ATTACHMENT 12

RADIATION CONTROL TRAINING COURSE
TENNECO POLYMERS, INC. SITE
FORDS, NEW JERSEY

I. Review of the Nature of Radioactivity and Ionizing Radiation
   - A. Types, Half-life, Decay Calculations
   - B. Interaction with Matter
   - C. Units of Radioactivity

II. Radionuclide Expected at Tenneco Polymers, Inc. Site
   - A. Decay Schemes of U-238 and U-235
   - B. Secular Equilibrium
   - C. Contamination Measurement using Scintillometer
   - D. Environmental Transport
   - E. Radon-222 Production

III. On-Site Laboratory
   - A. Gamma-Ray Spectrometry
   - B. Calibration of Spectrometer and Exposure Rate Meters
   - C. Quality Assurance

IV. Radiation Risk to Workers
   - A. Units of Radiation Dose
   - B. Risk Per Unit Dose

V. Worker Protection
   - A. Proper Handling Techniques
   - B. Contamination Control
   - C. Protective Clothing
   - D. Personal Dosimetry
   - E. Bioassay and Whole Body Counting

VI. Waste Disposal
   - A. Packaging
   - B. Documentation