ZONE III
EPA REGION 9

RCRA ENFORCEMENT, PERMITTING, AND ASSISTANCE CONTRACT

FINAL
ROCKETDYNE TECHNICAL SUPPORT AND FIELD OVERSIGHT DOCUMENT REVIEW FOR BUILDING 4059

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Prepared for:

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Washington, DC 20460

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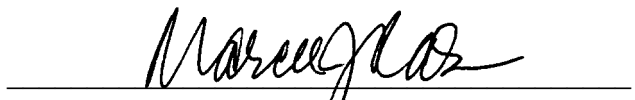

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ABBREVIATIONS AND ACRONYMS

cm^2	Square centimeter
DHS	Department of Health Services
DOE	U.S. Department of Energy
$Dpm/100cm^2$	disintegrations per minute per 100 square centimeters
EPA	U.S. Environmental Protection Agency
MARSSIM	Multi-Agency Radiation Site Survey Investigation Manual
MDC	Minimum detectable concentration
m	meter
µR/hr	microRem per hour
ORISE	Oak Ridge Institute for Science and Education
QA	Quality assurance
Rocketdyne	Boeing-Rocketdyne
SSFL	Santa Susana Field Laboratory
Tetra Tech	Tetra Tech EM Inc.

EXECUTIVE SUMMARY

This report documents completion of an independent technical review by Tetra Tech EM Inc. (Tetra Tech) of: (1) a decommissioning survey work plan and a final radiological survey report (Phase I) prepared by Boeing-Rocketdyne (Rocketdyne) for Building 4059 and (2) oversight and confirmation surveys of Building 4059 performed by Oak Ridge Institute for Science and Education. Building 4059 consists of a below-grade test vault (basement area), with two reactor test cells and support rooms; and an above-grade portion of the facility containing a high bay, control room, locker room, storage rooms, and equipment rooms. The Phase I survey and decommissioning of Building 4059 encompasses the above- and below-grade portions of the building down to, but not including, the activated structural materials in the reactor test cells. The Phase II survey and decommissioning of Building 4059 will address the activated structural materials surrounding the reactor test cells. A previous draft of this report was provided to the Santa Susana Field Laboratory (SSFL) Work Group and Rocketdyne for review and comment. This final report includes Rocketdyne's response to Tetra Tech comments, Tetra Tech's analysis of the Rocketdyne response and Tetra Tech's final summary and recommendations regarding Phase I of the Building 4059 decommissioning.

On November 15, 2001, the initial draft of this report was forwarded to the SSFL Work Group and Rocketdyne by the U.S. Environmental Protection Agency (EPA). In that initial draft report, Tetra Tech recommended that Rocketdyne provide the following information to EPA:

1. Additional detail concerning contaminated groundwater and activated structural components in Building 4059.
2. Additional information on how gamma measurements were used to assess the extent of activation of structural components in Building 4059.
3. Information regarding regulatory agency approval of the use of the building area dose factor.
4. Additional detail on survey instrument selection, calibration, sensitivity, and quality assurance practices.

Rocketdyne provided responses to the comments and recommendations in a letter forwarded to EPA on December 12, 2001. The Rocketdyne response to Tetra Tech comments and recommendations satisfactorily resolved each comment.

Based on the review of survey procedures and reports and the supplemental information provided by the December 2001 Rocketdyne submittal, Tetra Tech concludes that the Phase I portion of Building 4059 discussed in this report was adequately surveyed and that the surveys were sufficiently documented. The acceptability of the radiological surveys was based on a review of the practices that were ordinarily used within the industry at the time they were performed. The review considered:

- Sensitivity and reliability of the instruments used
- Frequency and rigor of instrument calibration
- Representativeness of sampling locations
- Level of detail
- Correlation between text and data tables
- Adequacy of documentation

1.0 INTRODUCTION

On May 30, 1997, Tetra Tech EM Inc. (Tetra Tech), formerly known as PRC Environmental Management, Inc., received Work Assignment No. R09805 from U.S. Environmental Protection Agency (EPA) Region 9, under Contract No. 68-W-99-008, Resource Conservation and Recovery Act Enforcement, Permitting, and Assistance, Zone III. As of April 1, 2002, this work assignment expired and incomplete tasks have been continued under Work Assignment No. R09107, under Contract No. 68-W-02-021. Tetra Tech was tasked to perform an independent assessment of the process used to evaluate the radiological status of Building 4059 at the Boeing-Rocketdyne (Rocketdyne) Santa Susana Field Laboratory (SSFL) in Santa Susana, California.

The work assignment has three basic components: (1) technical review and documentation of a review of measurements performed by Rocketdyne and the U.S. Department of Energy (DOE) contractor (Environmental Survey and Site Assessment Program, Energy/Environment Systems Division, Oak Ridge Institute for Science and Education [ORISE]); (2) independent measurements by the EPA contractor (Tetra Tech), and (3) evaluation of independent measurements performed by Tetra Tech.

Rocketdyne has implemented a two-phase approach to the decontamination, survey, and release of Building 4059. Phase I involves cleaning, survey, and unrestricted release of the above-grade portion of the facility and the below-grade portion of the facility down to, but not including, the neutron-activated (radioactive) structure surrounding the reactor test cells. Release of the Phase I portion of the building is to be followed by demolition of that portion of the facility and disposal of the debris. In Phase II, the radioactive materials exceeding DOE's release criteria in the lower portion of the building are to be removed and disposed as low-level radioactive waste, followed by survey and release of the excavation.

Rocketdyne, ORISE, and Tetra Tech have observed some neutron activation of structural components in the basement area (Phase I) of Building 4059 in addition to the reactor test cells. The Building 4059, Phase I Final Status Survey Procedure prepared by Rocketdyne discusses the presence of activation products in the structural components of the basement area of the building (1999c). The Building 4059, Final Status Survey Report (Phase I) prepared by Rocketdyne discusses the presence of activated structural material below the basement floor level in the reactor test cells (1999d). The survey report by ORISE confirms the presence of activated structural materials above the floor level of the Building 4059 basement. The independent survey by Tetra Tech also has identified activated structural steel above the basement floor in Building 4059.

No nationally recognized limits exist for assessing the appropriate concentrations of activation products for disposal, recycling, or release for unrestricted use. Rocketdyne has proposed, and DOE and the California Department of Health Services Radiologic Health Branch (DHS) have agreed to, establishing a boundary between the "activated" and "non-activated" areas of Building 4059. The boundary is based on actual solid samples in which the activation products Cobalt-60, Europium-152, and Europium-154, were detected at levels less than DOE would allow in contaminated soil. The allowable levels for contaminated soil were developed based on a 15 millirem per year individual dose and have been approved by DOE and DHS. The activated structural materials in the basement area do not exceed levels DOE would allow in soil and will be included as part of the Phase I program. The activation products in the reactor test cells exceed the levels DOE would allow in soil and will be included in the Phase II portion for radioactive materials.

Tetra Tech has also prepared a survey report for Building 4059, which will be issued separately.

2.0 SCOPE OF WORK

The scope of this report documents completion of an independent technical review by Tetra Tech of: (1) a decommissioning survey work plan and a final radiological survey report (Phase I) prepared by Rocketdyne for Building 4059 and (2) oversight and confirmation surveys of Building 4059 performed by ORISE. A previous draft of this report was provided to the SSFL Work Group and Rocketdyne for review and comment. This final report includes Rocketdyne's response to Tetra Tech comments, Tetra Tech's analysis of Rocketdyne's response, and Tetra Tech's final summary and recommendations regarding Phase I of the Building 4059 decommissioning.

Rocketdyne has elected to perform the decontamination, survey, and decommissioning of Building 4059 in two phases. The Phase I portion of the building consists of the above-grade portion of the building and the below-grade portion of the building, above the floor level of the reactor vault. The Phase II portion of the building is the structure below the floor of the reactor vault and includes the former reactor test cells. Documents reviewed for this project are identified in the reference section. The comments and recommendations resulting from the review are listed in Section 4.0, along with a brief summary and an analysis of the Rocketdyne response.

3.0 RADIOLOGICAL CRITERIA

Rocketdyne has made a commitment to meeting the radiological criteria set forth in the document entitled, Proposed Site Wide Release Criteria for Remediation of Facilities at the SSFL (Rocketdyne 1996), which includes alpha surface activity limits and beta-gamma surface activity limits for several categories of radioisotopes and an exposure rate (net) of 5 microRem per hour (μR/hr). For Building 4059, Rocketdyne has appropriately concluded that the beta-gamma surface activity limits for mixed-fission products and activation products are the applicable limits. Rocketdyne, ORISE, and most recently Tetra Tech, have observed neutron activation of structural components surrounding the reactor pits. No specific radiological acceptance criteria are identified to define the concentration of activation products in structural materials above which materials may not be released for unrestricted use. Rocketdyne proposed, and the regulatory agencies agreed to, use of limits less than soil contamination limits for the isotopes of concern. The supplemental information provided by Rocketdyne in their December 2001 letter includes detailed information regarding the presence of, and the planned actions for, activation products. This subject is discussed further in the document review sections that follow.

4.0 DOCUMENT REVIEW COMMENTS

This section provides Tetra Tech review comments and is divided into sections related to: (1) the Rocketdyne survey work plan and other planning documents, (2) the Rocketdyne survey report and measurement data, and (3) the ORISE report.

Specific findings for which a written response was recommended in the draft report are identified in boldface type. A brief summary of the Rocketdyne response to each comment follows the finding, along with a Tetra Tech analysis of the Rocketdyne response.

4.1 ROCKETDYNE SURVEY WORK PLAN AND OTHER PLANNING DOCUMENTS

Tetra Tech reviewed the Rocketdyne document entitled, Nuclear Operations at Rockwell's Santa Susana Field Laboratory – A Factual Perspective (Rocketdyne 1991). This document provides background on the history of Building 4059 and identifies the presence of activation products, contamination, and contaminated groundwater (the result of groundwater leaking into the contaminated facility). The decontamination and decommissioning of the below-grade portion of the building is planned as a two-phase project, as discussed below. Tetra Tech had no comments specific to this document. Tetra Tech reviewed the document entitled, Building 4059, Phase 1 Final Status Survey Procedure (Rocketdyne

1999c). The final status survey procedure is based on guidance contained in the Multi-Agency Radiation Survey and Site Investigation Manual ([MARSSIM] EPA 2000). The survey procedure discusses the two-phase project to be undertaken to survey, decontaminate, and release the facility. The survey procedure states: "In Phase I, the above-grade building and the below-grade portions (excluding the activated concrete in the north test vault) will be decontaminated, surveyed, released for demolition, and demolished. In Phase II of the Building 4059 project, the remaining activated concrete in the test pits below the floor level of the vault will be removed, packaged and disposed of as radioactive waste. The remaining excavation will then be sampled, surveyed, cleaned if necessary, and released."

Section 1.0 of Building 4059, Phase I Final Status Survey Procedure (Introduction) states that only activation products have been observed in Building 4059 and that no alpha emitters were detected. There is no indication of where previous surveys were performed and what those surveys revealed. Section 2.0 (Facility History) does not appear to provide sufficient detail to meet the intent of an historic site assessment, as described in MARSSIM. Additional detail about the location and extent of contamination or activation found in and around the reactor test cells would be beneficial in demonstrating that the Rocketdyne and ORISE surveys were effective. In addition, such detailed information will be valuable when the Phase II surveys are developed. Rocketdyne reference documents and the ORISE survey document discuss instances of groundwater leaking into the inactive facility and contamination of groundwater. The Phase II portion of the survey process must address the potential for groundwater contamination.

Recommended Rocketdyne Action No. 1 – Provide a separate HSA or supplement the Facility History section of the Building 4059, Phase I Final Status Survey Procedure to provide additional detail. Include sufficient information to allow the Phase II survey plan to adequately address the potential for the presence of activated structural materials and groundwater contamination. The location of any contaminated groundwater, the levels of contamination, the isotopes involved, and any remediation or containment actions taken to date should be included in the additional history information.

Rocketdyne Response to Recommended Action No. 1

Rocketdyne forwarded copies of several existing documents that provide detailed history of the Building 4059 use, survey, decontamination, and partial demolition. Tetra Tech review of these documents shows that Rocketdyne fully addresses the existence of activation products in the building structural materials surrounding the reactor test cells. Sketches of the building depict sampling locations for concrete, rebar, and steel liner, and a data table provides the gamma spectroscopy results for isotopes identified. A proposal to accomplish a two-phase survey and demolition of the building was submitted to DOE in a

Rocketdyne letter (Rocketdyne 1999a). The proposal was also forwarded to the DHS for review (Rocketdyne 1999b). The proposal defined the portion of the building containing activation products based on sample analysis. The above- and below-grade portions of the building to the level of the test vault floor were to be surveyed, cleaned as needed, surveyed by ORISE and DHS, and released from radiological controls by DOE and DHS. This portion of the building is Phase I and will be demolished and the debris disposed of by commercial means. That portion of the building below the test vault floor (Phase II) contains activated structural materials and will be demolished and disposed of in a radioactive waste disposal facility. After demolition and removal of the Phase II portion of the building, the excavation will be surveyed for release by Rocketdyne, ORISE, and DHS. After release from radiological controls, the excavation will be backfilled and restored. The proposed two-phased approach was approved by DOE letter (DOE 1999). A DHS letter also concurred with the two-phased approach (DHS 1999).

Additional information was provided concerning infiltration of groundwater into the below-grade test cell area of Building 4059 that was discovered in 1983. Groundwater leakage was inward. The water was found to contain Cobalt and was handled as radioactively contaminated water. Monitoring of groundwater wells in the vicinity of Building 4059 did not identify radioactive contaminants that might have originated in Building 4059. Groundwater management was initiated to maintain the level of groundwater in order to prevent contamination of groundwater by radioactive water inside of the building. Rocketdyne information indicates that no manmade radioactive contaminants, fission products, or fuel materials have been detected in any of the groundwater surrounding Building 4059. Low levels of tritium have been detected in groundwater wells near Building 4059. These levels are well below the drinking water standard. Since January 2000, the groundwater level in the wells surrounding Building 4059 has been maintained low for the purpose of eliminating groundwater from the Building 4059 foundation. Rocketdyne intends to maintain the groundwater low until completion of the two-phase survey/demolition/release process and the excavation has been backfilled.

Tetra Tech Analysis of Rocketdyne Response to Recommended Action No. 1

The additional information provided by Rocketdyne in response to this comment satisfies the recommendations of MARSSIM relative to documenting the facility history. No further action is required.

Section 1.0 of the Building 4059, Phase I Final Status Survey Procedure (Rocketdyne 1999c) states that Rocketdyne will use 1-minute gamma exposure measurements at floor level and at 1 meter (m) above

floor level to assess volumetric contamination, that is, activation of structural materials. The survey technique indicated in the procedure is to hold the survey instrument 1 m above the floor surface while taking a 1-minute integrated reading. This technique will not necessarily identify localized activated areas. The beta-gamma scans performed at the surface of the floors and walls likely would be more useful in identifying localized areas of activation. The survey procedure does not provide any acceptance criteria for activation, that is, volumetric contamination. The criterion provided for the gamma reading is equal to, or greater than, 4,200 counts per minute, while the criterion for the beta-gamma scan is greater than twice background. There is no correlation between these readings and levels of activation in concrete or steel. It is not clear whether the regulatory agencies (DOE and DHS) have agreed on acceptance criteria for levels of activation for Building 4059. The survey plan indicates that "defin(ing) the area (volume) of the facility that will be treated as radioactive waste by core sampling and analysis of concrete and steel liner and performing analyses to segregate 'clean' volume from activated material" was completed previously. The data gathered through the core sampling and analysis should be provided. Tetra Tech has reviewed Building 4059, Final Status Survey Report (Phase I) (Rocketdyne 1999d). The survey report contains 1-minute gamma readings from selected survey units. The gamma readings are presented as gross counts per minute minus background counts per minute, converted to microRem per hour, using a standard conversion factor. It is not clear whether these gamma readings are taken at floor surface level or at 1 m above the floor. It is also not clear whether gamma readings were taken at both surface and 1 m above the surface using the same gamma instrument.

Recommended Rocketdyne Action No. 2 – Revise the Building 4059, Final Status Survey Report (Phase I) to provide an explanation of how the gamma measurements at both floor surface and at 1-meter above the surface were taken. Provide an explanation of how 1-minute gamma measurements were used to assess volumetric contamination and what limits are applicable to those measurements. Have the appropriate regulatory agencies approved those limits? Provide an addendum to the Building 4059, Final Status Survey Report or provide a separate report to formally document the locations from which the concrete and steel core samples were previously collected and the results of the analyses of those samples.

Rocketdyne Response to Recommended Action No. 2

Rocketdyne reported in the December 2001 response that the "1-meter exposure measurements were **not** designed to detect undefined levels of volumetric activation products." The intent of the Building 4059 Survey Procedure and the Final Status Survey Report (Phase I) was to establish that approved surface contamination guidelines were satisfied and to verify that ambient gamma radiation levels in the building did not exceed the Rocketdyne imposed limit of 5 μR/hr above background. The Phase I portion of the building is to be demolished and the debris disposed of commercially. The Phase II portion of the building

will be demolished and the debris disposed of as radioactive waste. Rocketdyne acknowledges that no specific activation concentration limits have been established. The two-phase approach to cleanup, survey, and release of Building 4059, approved by both DOE and DHS, establishes a dividing line between the activated and nonactivated areas of the building, based on actual maximum activity levels measured in concrete core and steel rebar and liner samples. For the three isotopes of concern (Cobalt-60, Europium-152, and Europium-154) the actual maximum measured values are less than the approved soil release criteria.

Tetra Tech Analysis of Rocketdyne Response to Recommended Action No. 2

The supplemental response from Rocketdyne resolves the outstanding question of how the activated structural materials were identified and how the boundaries were defined. As noted by Rocketdyne, the appropriate regulatory agencies have approved the two-phase approach and the method of defining the boundaries. No further action is required.

Section 3.9.3.1 of the Building 4059, Phase I Final Status Survey Procedure (Rocketdyne 1999c) proposes using a building area dose factor of 3.0 to derive a scan minimum detectable concentration (MDC). MARSSIM indicates a need to obtain regulator approval for an area factor for use in determining a scan MDC. An area factor is used to determine whether additional measurement locations are needed to ensure detection of small areas of elevated activity. In this case, the required scan MDC is calculated by Rocketdyne to be 15,000 disintegrations per minute (dpm) per 100 square centimeters (cm^2). The actual calculated scan MDC reported in the survey procedure is 3,928-dpm/100 cm^2. Rocketdyne should indicate if the regulatory agencies approved use of the area factor.

Recommended Rocketdyne Action No. 3 – Indicate what regulatory approval was obtained for use of the building area dose factor.

Rocketdyne Response to Recommended Action No. 3

The December 2001 Rocketdyne response forwarded a letter from DHS (April 2000) specifically approving the area dose factor used for Building 4059.

Tetra Tech Analysis of Rocketdyne Response to Recommended Action No. 3

The requested information has been provided. No further action is required.

4.2 BOEING-ROCKETDYNE SURVEY REPORT AND MEASUREMENT DATA

Survey reports were less detailed than MARSSIM specifies. The intent of MARSSIM is that the final status survey report be a stand-alone document to the extent possible. To ensure completeness and allow for public review as MARSSIM intends, final survey reports should be revised to include more detail.

Recommended Rocketdyne Action No. 4 – Revise the Building 4059, Final Status Survey Report (Phase I) to provide a more detailed description of the basis for release of the facility as follows:

- **A discussion of the instrument calibration methods and suitability for the isotopes of concern. Were the instruments used calibrated for the isotopes of interest?**
- **A discussion of the measurement sensitivity for each detector in scanning and fixed count mode. Did the instruments used meet the criteria set forth in MARSSIM for sensitivity for fixed-point surveys?**
- **A discussion of quality assurance practices and duplicate and independent measurements performed, as well as ongoing quality control measures.**

Rocketdyne Response to Recommended Action No. 4

The December 2001 letter provides all the information requested by Tetra Tech concerning the calibration of survey instruments, sensitivity of survey instruments, and the quality control and quality assurance (QA) practices in use during surveys. Specifically, all survey instruments were calibrated quarterly using National Institute of Standards traceable sources. Calibration sources used were identified and were appropriate for the isotopes of concern. As is noted in the Rocketdyne response, the sodium iodide instruments are energy-dependent. Therefore, calibration of the gamma survey instrument included use of a Reuter-Stokes pressurized ion chamber to determine a conversion factor for converting the sodium iodide gamma detector readings in counts per minute to microRem per hour. Sensitivity of survey instruments was well below MARSSIM guidelines for beta-gamma surveys. Finally, QA practices included instrument settings checks, background response checks, and source response checks three times per shift during surveys. Control charts were used to track the accuracy of the laboratory instruments such as the swipe counter and the gamma spectroscopy instrument.

Tetra Tech Analysis of Rocketdyne Response to Recommended Action No. 4

The requested information regarding QA was provided. Although the initial recommendation was for Rocketdyne to revise the Final Status Survey Report and incorporate the provided information, providing the QA information separately also is acceptable. MARSSIM guidelines are recommendations, rather than strict requirements. No further action is required.

4.3 OAK RIDGE INSTITUTE OF SCIENCE AND EDUCATION REPORT

Tetra Tech reviewed the Verification Survey of Building 4059 (Phase I) (ORISE 2000), the verification survey report prepared by DOE's oversight verification contractor, ORISE. The ORISE report indicates that measurement and sampling locations were referenced to existing grids established by Rocketdyne. The maps included in the ORISE report that show measurement and sampling locations do not include grid identification, and the data tables are summary tables that show ranges of measurements in each area surveyed, rather than specific measurement data related to specific grid locations. It is not possible to compare ORISE data with previous Rocketdyne data on any basis other than a summary one.

Recommended ORISE Action No. 1 – Revise the ORISE report to reference the specific measurement and sampling data pertinent to the Rocketdyne grid locations.

Discussion: The ORISE survey was conducted at the request of DOE to provide DOE with measurement and sampling data to determine the radiological status of the building. Further review of the objectives of the ORISE survey does not indicate that ORISE data will be compared to Rocketdyne data on a grid-by-grid basis. No response was requested from ORISE. No further action is required.

5.0 SUMMARY AND RECOMMENDATIONS

Based on reviews of survey procedures and reports, Tetra Tech concludes that the Phase I portion of Building 4059 was adequately surveyed and that the surveys were sufficiently documented. In particular, the early concerns of this review regarding the presence of activation products and the potential for groundwater contamination have been addressed by Rocketdyne. No further survey action is considered necessary for the Phase I portion of Building 4059. The acceptability of the radiological surveys was based on a review of the practices that were ordinarily used within the industry at the time they were performed. The review considered:

- Sensitivity and reliability of the instruments used
- Frequency and rigor of instrument calibration
- Representativeness of sampling locations
- Level of detail
- Correlation between text and data tables
- Adequacy of documentation

All of the specific comments to Rocketdyne documents for Building 4059 have been reviewed and resolved. No further survey action is considered necessary for the Phase I portion of the building discussed in this report.

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