Independent Oversight Follow-up Review of the Hanford Site Chronic Beryllium Disease Prevention Program

January 2014

Office of Safety and Emergency Management Evaluations
Office of Enforcement and Oversight
Office of Health, Safety and Security
U.S. Department of Energy

Table of Contents

Acronyms

BeCAP	Beryllium Corrective Action Program
BWP	Beryllium Work Permit
CBDPP	Chronic Beryllium Disease Prevention Program
CFR	Code of Federal Regulations
CHPRC	CH2M-Hill Plateau Remediation Company
DOE	U.S. Department of Energy
EJTA	Employee Job Task Analysis
HPMC	HPM Corporation
HSS	Office of Health, Safety and Security
HSWET	Hanford Site Worker Eligibility Tool
IH	Industrial Hygienist
IHT	Industrial Hygiene Technician
MSA	Mission Support Alliance
OFI	Opportunity for Improvement
OMP	Occupational Medical Provider
ORP	Office of River Protection
OS&IH	Occupational Safety and Industrial Hygiene
RCT	Radiological Control Technician
RL	Richland Operations Office
WCH	Washington Closure Hanford
WRPS	Washington River Protection Solutions

Independent Oversight Follow-up Review of the
Hanford Site Chronic Beryllium Disease Prevention Program

1.0 PURPOSE

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), performed a follow-up review of corrective actions taken to improve the Hanford Site chronic beryllium disease prevention program (CBDPP). The purpose of the review was to provide the Richland Operations Office (RL), the Office of River Protection (ORP), and site contractor management with an assessment of the effectiveness of the implementation of key corrective actions taken in response to the 2010 HSS inspection of the Hanford Site CBDPP, specifically with respect to beryllium postings and facility assessments and characterizations.

2.0 BACKGROUND

Independent Oversight conducted an inspection of the Hanford Site CBDPP in April and May 2010 at the request of the Assistant Secretary for Environmental Management. The 2010 Independent Oversight inspection identified a number of deficiencies in the content and implementation of the CBDPP, resulting in 4 findings, 14 cross-cutting opportunities for improvement (OFIs), and numerous specific OFIs. In response to the 2010 Independent Oversight inspection report, Hanford Site management developed a detailed corrective action program and schedules to address these identified deficiencies through the development and implementation of 74 beryllium corrective action program (BeCAP) products.

In April 2011 (report dated June 2011); Independent Oversight performed a follow-up review of the status of corrective actions taken by the contractor in response to the 2010 inspection report. Independent Oversight determined that interim actions had been taken and that organizations demonstrated commitment to improving the program. However, various aspects of the corrective action plan warranted improvement, and concerns about the timeliness of corrective action implementation were identified.

As of October 2012, several BeCAP products had been reported as completed, but the only ones reported as being implemented in the field were various interim actions as defined by RL, ORP, and the beryllium work permit (BWP) process. In November 2012, Independent Oversight performed a second follow-up review of the contractor's corrective action status, focusing on the effectiveness of the BWP process, which found that the BWP procedures were well-written and consistent with the requirements of the Hanford CBDPP (Rev. 1) and 10 CFR 850, and that the BWP process was being implemented in accordance with the BWP procedures and BWP training. However, the Independent Oversight team also identified several opportunities to enhance program design and implementation, and continued to express concerns about the rate of progress in completing long-term actions (recognizing that interim measures were in place to mitigate risks).

During the week of November 4-7, 2013, Independent Oversight performed a third follow-up review of the status of corrective actions taken by the contractor in response to the 2010 inspection report. The focus of this review was to review the status of the next series of BeCAP products, namely beryllium postings, and the process for conducting beryllium facility assessments, characterization, and building verifications. The results of this review are the subject of this report.

3.0 SCOPE

The onsite portion of the follow-up review was performed November 4-7, 2013, by a team of Independent Oversight personnel, as listed in Appendix A. During the onsite data-gathering portion of this review, the Independent Oversight team met with managers, technical staff, and workers; reviewed records and documents, including completed draft characterization and sampling plans; and observed beryllium team meetings (e.g., a BeCAP Core Team meeting), training, and work activities to assess the effectiveness of the implementation of the posting and characterization process and ongoing beryllium training. The Independent Oversight team also met with selected Hanford Site stakeholders to gather their perspectives.

The Independent Oversight team focused on assessing the draft CBDPP procedures and pilot programs for implementation of the new beryllium postings and the facility assessment, characterization, and building verification program by four Hanford Site contractors – Mission Support Alliance (MSA), CH2M-Hill Plateau Remediation Company (CHPRC), Washington Closure Hanford (WCH), and Washington River Protection Solutions (WRPS) – as well as the beryllium training provided at the Hanford Site's Volpentest HAMMER Federal Training Center, also known as the HAMMER Training Facility. The site occupational medical provider (OMP), HPM Corporation (HPMC), was assessed on its revisions and improvements to the CBDPP, Rev. 2A and its Attachment 4, *Medical Support Plan.*

4.0 RESULTS

4.1 Overview of the Implementation Status of the Posting, Assessment, and Characterization/Verification Process

The implementation of BeCAP products for beryllium postings and facility assessments, characterization, and verification reflects a significant milestone in the development and implementation of the Hanford beryllium program. CBDPP (also referred to as DOE-0342, which includes various subordinate procedures) Rev. 1 was completely revised (now Rev. 2A), and four new CBDPP procedures were developed for the assessment and characterization/verification of buildings (DOE-0342-002), beryllium posting and labeling requirements (DOE-0342-003), assessment and characterization/verification of structures and Conex boxes (DOE-0342-004), and evaluation of electrical equipment (DOE-0342-005). The BeCAP team recognized that completion of assessments and associated characterization/verifications will take a significant amount of time and appropriately specified interim controls to be used for intrusive work during the implementation period. The BeCAP Team also recognized that training for the contractor workforce, supervisors, work planners, industrial hygienists (IHs) and industrial hygiene technicians (IHTs) was needed to ensure successful implementation of these changes. However, expectations for industrial hygiene evaluations prior to intrusive work have not been fully developed at the time of the review. (See **OFI-1**.)

At the time of Independent Oversight's onsite review, each of the four site contractors had begun to implement the changes described in these new documents to varying degrees and HPMC had implemented a number of products assigned to the OMP as described in the following sections. However, resolution of issues identified by the BeCAP team is necessary to support implementation. These issues included the level and type of training for postings and electrical component characterizations associated with CBDPP, Rev. 2A and integrating new work control requirements into contractor work planning and control processes. During the review, the Independent Oversight team observed BeCAP team interactions aimed towards resolving the remaining issues. During these interactions, some progress was apparent but further effort is necessary to fully resolve the issues. In addition, during several interactions, some contractor representatives indicated that contract direction

from RL and/or ORP was necessary to complete actions to resolve the issues and begin implementation of CBDPP, Rev. 2A.

4.2 Assessment of CBDPP Training for the Posting, Assessment, and Characterization/ Verification Process

The Independent Oversight team observed two beryllium training courses: one for beryllium postings, assessment, characterization, and verification, and the other for beryllium sampling techniques. The audience for both courses was Hanford IHs and IHTs who are involved with implementation of the sitewide beryllium program.

Training Course No. 004114, *Beryllium Postings, Assessment and Characterization and Authorization,* was observed on November 4, 2013. This eight-hour course provides IHs and IHTs with instruction in posting and labeling in accordance with DOE-0342-003, the processes for performing a beryllium facility assessment in accordance with DOE-0342-002 and DOE 0342-004, developing beryllium characterization/verification sampling plans, collecting and analyzing sampling results, and preparing characterization/verification reports in accordance with DOE-0342-002 (Buildings), DOE 0342-004 (Structures/Conex boxes), and DOE-0342-005 (Electrical Equipment).

Among the four Hanford Site contractors, approximately 150 IHTs/IHs will be involved in implementing the Hanford beryllium program, and all are required to complete this course. As of the day of this review, over 90 percent of the site IH/IHTs had completed the course, and only three classes remained to be scheduled (mainly for WRPS). The class observed by the team was conducted at the HAMMER Federal Training Center, and the instructors were a certified IH and an IHT Worker Trainer, both associated with the site beryllium program. Twelve IHs/IHTs attended the course.

The following positive attributes were noted for the course:

- The course was informative, and the instructors were knowledgeable of the course material. When students raised questions that the instructors could not answer, the questions were listed on a "parking lot" board for further investigation.
- Students were provided with a course manual, as well as a copy of the CBDPP and the four new posting and characterization implementation procedures.
- Throughout the course, there was considerable class participation and questions.
- After completion of each teaching module, there was an interactive review, and the class relied on group exercises to enhance understanding of the course material.

Training Course No. 004115, *Beryllium Sampling Techniques*, was observed on November 6, 2013. This two- to four-hour course is intended to provide basic instruction to site IHs/IHTs in the techniques for bulk and wipe sampling for beryllium in accordance with DOE-0342-002. The course concludes with a "practical factors" demonstration during which students are required to collect both wipe and surface samples. The course includes two videos on how to collect surface samples via wipe sampling or bulk sampling. The course is well designed and provides mechanisms to convey the required information using a variety of media (e.g., videos, slides) and evaluates student knowledge through a graded practical factors demonstration. As of the date of the review over 90% of the IHs/IHTs had attended the course.

4.3 Assessment of the Posting, Assessment, and Characterization/Verification Process

The following paragraphs provide an assessment of the status of each of the four Hanford Site contractors with respect to the implementation of changes to the CBDPP (i.e., Rev. 2A) and associated procedures.

4.3.1 Implementation by Mission Support Alliance

MSA recognized the potentially significant impact of the new CBDPP changes and, having some funds available for this activity, began pilot implementation studies in June 2012. Thirty buildings, structures, and Conex units were included in the pilot study, and to date all of these facilities have been assessed, characterized, and sampled, as needed. After completing the pilot study, MSA began implementing the facility assessment, characterization, and verification processes on the remainder of the 663 buildings, structures, and Conex units under its jurisdiction. Overall, to date, facility assessments have been completed in accordance with DOE 0342-002 and DOE-0342-003 for 160 buildings/facilities, 38 structures, and 96 Conex units, with the exception of final signatures on the documents pending RL's issuance of the CBDPP procedures. The second phase of implementation of Rev. 2A of the CBDPP is developing sampling plans and conducting bulk and/or surface sampling in accordance with those plans. To date, MSA has sampled 151 facilities, 19 structures, and 94 Conex units. During 2012, 513 beryllium wipe (surface) samples and 412 bulk (dust/debris) samples were collected and analyzed. During the first 10 months of 2013, 2,513 wipe samples and 1,572 bulk samples have been collected and analyzed. To achieve this volume of assessments and beryllium sampling, MSA contracted with a support contractor for six IHs/IHTs who are dedicated to this task. As a result of this significant level of effort, the MSA team has been able to characterize many of the MSA buildings, clear a number of potential beryllium suspect areas through beryllium sampling, and provide useful feedback to the BeCAP team that has resulted in some changes to the CBDPP (e.g., relaxed the requirement to perform surface sampling for each bulk sample collected).

With respect to training, all of the MSA IHs/IHTs designated to support the implementation of Rev. 2 of the CBDPP have received both the facility assessment and the sampling training described in Section 4.2. In addition, most of the MSA workers have received the briefing on the new postings designed by the BeCAP committee.

The Independent Oversight team also had an opportunity to observe beryllium sampling of one of the beryllium survey units in Building 2266E, which is occupied and houses machine and carpentry shops, tool cribs, and electrical rooms, as well as offices and conference rooms. The three-person IH beryllium sampling team followed the instructions and sampling techniques provided in DOE 0342-002 and associated training. Approximately 24 bulk and wipe samples were obtained from this survey unit (machine storage area), including surface samples from desks, equipment, and walls and bulk samples of equipment metal fines and other debris extracted from lathes, drill presses, and local ventilation systems. One potential area of concern is that these new CBDPP procedures, once approved for implementation, will require considerable IH support in the performance of IH evaluations for non-assessed buildings, which could impact IH resources and support for ongoing work activities. (See **OFI-1**.)

4.3.2 Implementation by Washington River Protection Solutions

WRPS facilities that are within the scope of the CBDPP, Rev. 2A implementation include approximately 265 buildings, 165 structures (e.g., valve pits, risers, exhaust systems), and 200 Conex boxes. In 2010, as part of implementation of Rev. 0 of the CBDPP, WRPS completed a beryllium sampling effort for 47 buildings considered the most likely to contain beryllium. Data from this effort is readily retrievable and will be used as supplemental sampling data as appropriate to fulfill the more rigorous sampling requirements for CBDPP, Rev. 2A for assessments and characterization and/or verification sampling.

Current WRPS activities related to CBDPP, Rev. 2A implementation include working through the WRPS CBDPP, Rev.2A pilot implementation program proposal originally submitted to DOE in July 2013 (resubmitted in October 2013); training staff on the new sampling and characterization procedures;

developing posting communication plans; and preparing for and participating in BeCAP committee and BeCAP team meetings.

The WRPS pilot implementation program consists of beryllium facility assessments and partial characterization and/or verification of four buildings, four mobile offices, six Conex boxes, and three structures. WRPS has completed the facility assessment phase for all but the mobile offices, but has not yet developed sampling plans or accomplished the actual beryllium sampling for these areas. In addition, WRPS considers assessment and sampling requirements for structures and Conex boxes to be unfunded, based on its current contract with DOE.

Training of WRPS staff responsible for implementation of CBDPP, Rev. 2A is well under way. Most industrial hygiene staff have completed the courses on the new characterization and sampling procedures, including 10 of 13 IHs, 32 of 54 IHTs, 3 of 3 industrial hygiene supervisors, and 5 of 15 safety professionals. WRPS has also developed a beryllium posting and communications plan and an implementation strategy document describing the steps and a tentative schedule for achieving full implementation.

4.3.3 Implementation by CH2M-Hill Plateau Remediation Company

CHPRC facilities that are within the scope of the CBDPP implementation include approximately 315 buildings, 211 mobile offices, 197 structures (e.g., valve pits, risers, exhaust systems), and 238 Conex boxes. CHPRC has completed facility assessments for 15 buildings that were not part of the pilot implementation project. Data from this effort and the pilot implementation project are readily retrievable and will likely be used where appropriate during implementation of Rev. 2A of the CBDPP. Pilot implementation project efforts included assessment and characterization/verification procedures, staff training on the new procedures, and posting and worker communication initiatives.

CHPRC pilot implementation program commitments include 30 assessments, 29 of which have been conducted; 30 walkdowns, all of which have been conducted; 24 characterization walkdowns, all of which have been conducted; 24 characterization plans, 22 of which have been developed; 17 sampling activities, 10 of which have been conducted; and 17 sample reports, 6 of which have been completed.

Training of staff responsible for implementation is nearly complete. All 13 CHPRC staff professional IHs have attended both courses, 6 IHTs have completed all training, both Occupational Safety and Industrial Hygiene (OS&IH) managers have attended both courses (two open manager positions), the OS&IH Director has attended both courses, and all 4 OS&IH professionals who may do sampling have attended both courses. Training associated with beryllium posting and labeling changes, including briefings to workers, have been completed for all CHPRC work groups. Makeup sessions are being conducted to brief workers who missed the regularly scheduled briefings.

The CHPRC implementation strategy includes a draft implementation plan, which has been developed. A detailed implementation schedule for assessment and characterization is being developed based on the data from the pilot implementation project. The implementation strategy will be communicated along with other items being developed as part of the sitewide communication plan.

The Independent Oversight team observed CHPRC characterization sampling activities at Building 225-B, the Waste Encapsulation and Storage Facility. The sampling plan initially called for sampling three distinct areas: the pool cell bridge crane, the hot manipulator repair shop (a radiological contamination area), and the cold manipulator repair shop, Room 205 (a radiological buffer area). However, the sampling plan had some work planning deficiencies; for example, it lacked a work package and support for lockout/tagout and fall protection for accessing the bridge crane, and did not provide for radiological

support, including a radiological work permit and radiological control technician (RCT) coverage for access to the hot shop. Consequently, sampling could be supported only at the cold manipulator repair shop (Room 205), where operations personnel and RCT support were provided. Sampling was conducted by a CHPRC IH after a walkdown with both bargaining unit and operations Nuclear & Chemical Operators (NCO) personnel and completion of a Beryllium Facility Assessment Form for Buildings. An interview with the IH indicated that the walkdown identified no specific areas of concern, however, the actual assessment form for this location, indicated that for both past and current uses, tool maintenance activities were "Areas of Concern."

All sampling was conducted in accordance with the training observed by Independent Oversight, with each sampling evolution subject to the professional judgment of the IH or IHT. However, Independent Oversight noted some concerns with respect to beryllium sampling. For example, in one case, the facility characterization plan called for 12 samples of work surfaces, without providing any specifics for the sampling plan (e.g., number of vertical or horizontal surfaces, equipment items to be sampled). The IH performing the sampling elected to obtain only wipe samples from four horizontal surfaces and eight vertical samples (mostly on walls), but took no samples from surfaces above six feet or from tool rests or work surfaces for either the grinder or drill press in the shop. The interiors and exteriors of the numerous tool boxes located throughout the shop and the surfaces of the horizontal wiring troughs were not sampled. Work benches adjacent to tool boxes were not sampled, and no bulk samples were collected even though dusts and metallic shavings were evident on equipment work surfaces and/or pedestals. In short, all of the samples were wipe samples collected from apparently clean surfaces (including surfaces that had been scanned for radiological contamination before being sampled for beryllium, potentially biasing the sample), and no bulk samples were collected. Although the sampling was within the parameters of the new CBDPP procedures, there is considerable variation in the professional judgment of those performing the sampling. (See **OFI-2**.)

4.3.4 Implementation by Washington Closure Hanford

WCH has completed more than 90 percent of its scheduled decontamination and demolition projects; the contract completion date is 2015. The WCH beryllium program lead continues to support all aspects of the BeCAP process and interfaces with all relevant BeCAP product teams. The program lead is also a certified health advocate and provides support and counseling to both WCH employees and all WCH subcontracted workers who require affected-worker counseling.

WCH and RL are in continuing discussions to clarify the funding mechanisms for WCH's implementation of Rev. 2A of the CBDPP. Although IH and IHT training has been completed and interfacing procedures are ready for revision, no worker training, pilot implementation programs, or changes to posting and labeling training have been scheduled.

WCH has implemented a lower-tier beryllium committee that is intended to communicate CBDPP information directly to field workers and convey questions, concerns, and suggestions from the field to the beryllium lead for resolution. It has been proposed that the lower-tier committee structure be formalized with a committee charter. If approved, the charter is expected to expand to all four major Hanford contractors.

4.4 Occupational Medical Progress in Implementing the Hanford Beryllium Program

HPMC has continued to make progress completing the BeCAP corrective actions that are assigned to the Hanford OMP. Of the 14 BeCAP products assigned, 6 have been completed, 5 are currently active, and 3 remain inactive. Most of the completed corrective action product elements have been implemented, such

as revised forms, simplified algorithms, improved informational materials, and expanded definitions in DOE-0342, Rev. 2A and Attachment 4, *Beryllium Medical Support Plan*. The active BeCAP products are supported by a team of medical professionals and HPMC support personnel, including the site occupational medical director, beryllium program coordinator, beryllium case manager, risk communicator, and epidemiologist. The BeCAP core team is expected to finalize a process to facilitate closure for most of the completed medical-related BeCAP products by the end of November.

Several legacy beryllium program concerns associated with the voluntary medical surveillance program, beryllium registry, health advocate program, and the site employee job task analysis (EJTA) process are being addressed by the occupational medical BeCAP product teams:

- The voluntary beryllium medical surveillance program no longer informs workers' management that beryllium surveillance has been requested. Voluntary beryllium surveillance information provided to workers has been updated and outreach communication has been expanded. The informed consent language used by the OMP has been modified to reflect the most current language in the CBDPP.

- The beryllium registry continues to be coordinated through the Hanford Site OMP. Following a root cause analysis and discussions between RL, Hanford contractors, and DOE Headquarters staff, the beryllium registry data continues to be provided as required. Site personnel responsible for providing beryllium registry data have participated in training, procedure revisions, and discussions on correcting data reporting errors.

- Deficiencies noted in the Hanford site EJTA process during the 2010 CBDPP inspection have been partially resolved to ensure that the OMP can provide accurate and comprehensive medical surveillance programs for employees. Expectations and direction for the site EJTA process were communicated from RL and ORP to the Hanford Site contractors in a December 2011 memo. This communication was intended to serve as a reminder to all contractors of the purpose and expectations for the EJTA program. Recent interviews with contractor environment, safety, and health personnel and workers during an earlier HSS review indicated a strong awareness of the EJTA program expectations and its importance in protecting workers. RL also indicated that program effectiveness was to be determined by contractor self-assessments and follow-up presentations to the site's senior management team. A potential concern remains, that the database to capture and manage the site EJTA data was reported to be outdated and no longer supported by the original manufacturer. This database currently limits medical personnel's ability to access historical EJTA data and work history. The RL beryllium program lead indicated that funding for EJTA software replacement and data transfer is not available under the current budget restraints.

- Training for site health advocates responsible for counseling workers who have become sensitized to beryllium or have chronic beryllium disease is now formalized in a HAMMER-supported certification course. This course outlines the core information health advocates will need to effectively support and inform affected workers concerning benefits, training, and compensation. All four major contractors have certified health advocates on staff to ensure that workers receive consistent, effective information.

- The Hanford Site Worker Eligibility Tool (HSWET), which became inoperable during the HPMC transition, is now operational and available to managers and supervisors in the field. This database verifies a worker's certification or restrictions for working in controlled or hazardous areas at the Hanford Site.

- Beryllium program outreach activities by the risk communication staff have been significantly expanded to include external presentations to the regional medical community for such groups as medical professional conferences, state health association meetings, and state case management workers who may review Hanford worker compensation claims.

5.0 CONCLUSIONS

The Independent Oversight team recognizes that Rev. 2A of the CBDPP and the four new associated procedures for beryllium posting, facility assessment and characterization/verification, and beryllium sampling represent a significant accomplishment in the continued evolution of the Hanford beryllium program. Furthermore, although RL and ORP have not yet directed the four site contractors to fully implement these procedures, each of the contractors has begun some implementation of these new procedures and practices, if only on a pilot scale. For example, MSA has already expended considerable resources in assessing, characterizing, and sampling its facilities and has largely implemented the new process for most of its facilities. Independent Oversight's observations of the CBDPP training program were consistent with previous training observations: in general, the training was well organized, informative, and professionally presented.

The Independent Oversight team concurs with site management and the workforce that once implemented, Rev. 2A of the CBDPP and the associated procedures will significantly improve the Hanford beryllium program and enhance beryllium controls for worker protection. Appropriate interim controls have been established to support implementation; however, further defining the expectations for industrial hygiene evaluations prior to intrusive work activities will require thoughtful consideration to ensure both a proper balance between production and safety and alignment within the BeCAP team prior to implementation. Although resolution of issues impacting the implementation of CBDPP, Rev. 2A is underway, site organizations need to place more emphasis on timely resolution of the issues and ensure there is clear contractual direction for implementation, while respecting the BeCAP processes. The observed differences in sampling techniques indicate that some additional initial oversight by RL and ORP may be appropriate to help ensure the quality of implementation.

6.0 OPPORTUNITIES FOR IMPROVEMENT

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

OFI-1: RL and ORP should ensure that each contractor adequately defines the mechanisms and processes that IHs will use to evaluate the potential for beryllium hazards before conducting intrusive activities in unassessed facilities, outdoor areas, and previous demolition sites.

OFI-2: RL and ORP should provide some ongoing oversight of assessment and characterization/verification activities to ensure consistent quality of implementation of Rev. 2A of the CBDPP among the four site contractors.

7.0 ITEMS FOR FOLLOW-UP

Independent Oversight will continue to follow up on the implementation of key BeCAP processes as they progress toward completion, including assessment of BeCAP product implementation.

Appendix A
Supplemental Information

Dates of Review

Onsite Review November 4-7, 2013

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
Thomas R. Staker, Deputy Director for Oversight
William E. Miller, Deputy Director, Office of Safety and Emergency Management Evaluations

Quality Review Board

William A. Eckroade
John S. Boulden III
Thomas R. Staker
Michael A. Kilpatrick

Review Team

Thomas R. Staker, Team Leader
Marvin J. Mielke
Joseph Lischinsky
James R. Lockridge
Mario A. Vigliani