

September 15, 2017

BY OVERNIGHT MAIL AND ELECTRONIC MAIL

40-8903

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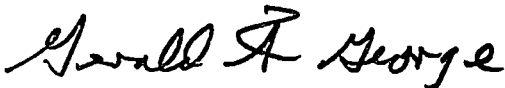
Re: Submission of Root Cause Analysis under Conditions 1 and 2 of the Confirmatory
Order of March 28, 2017 modifying License No. SUA-1471, EA-16-114

Dear Sir or Madam:

Attached is the Root Cause Analysis as required under Conditions 1 and 2 of the March 28, 2017
Confirmatory Order for the Homestake Grants facility.

If you have any questions, please contact me as soon as possible.

Sincerely,



Gerald F. George
Counsel for Homestake Mining Company of California

cc: NRC Document Control Desk (Hard Copy)
Patricia Holahan, Director of OE (email)
: Andrea Kock, Deputy Director of DUWP (email)
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DEO1
NMSSD1
NMSS
NRC/OE

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

1.0 Introduction

This Root Cause Analysis (RCA) Report has been developed in accordance with: 1) Conditions 1 and 2 in the Confirmatory Order (CO) Modifying License dated March 28, 2017 issued to the Homestake Mining Company of California (HMC; licensee for Materials License No. SUA-1471) by the Nuclear Regulatory Commission (NRC) under Docket No. 040-08903; and 2) HMC's Root Cause Protocol dated July 26, 2017. The CO resulted from a Settlement Agreement between HMC and NRC reached after mediation regarding apparent violations at HMC's Grants, NM Site (Site). This RCA Report addresses the five apparent violations identified in a letter from NRC to HMC dated October 4, 2016:

1. Implementation of the Reinjection Program in a manner inconsistent with the groundwater Corrective Action Plan (CAP);
2. Discharge of liquid effluents at Sampling Point 2 (SP2) in excess of the Site groundwater protection standards (GWPS) established in the License;
3. Failure to report to NRC the results of all effluent monitoring required by the License, specifically for SP1 and SP2;
4. Failure to obtain monthly composite samples as required by the License, specifically for SP1 and SP2; and
5. The discharge of liquid effluents containing byproduct material to land application areas without first obtaining NRC approval.

For this RCA, HMC assessed past and present Site conditions included, but was not limited to, interviews with former and current HMC staff and contractors and a review of key Site documents and history. The documents that were reviewed included License Amendments, reports developed by HMC-initiated Safety and Environmental Review Panels (SERPs), NRC Technical Evaluation Reports (TERs) and correspondence between HMC and the following agencies: NRC; the New Mexico Environment Department (NMED); and the U.S Environmental Protection Agency - Region 6 (EPA).

The findings presented in this RCA Report are based on the activities described above and the results of implementing the 5 Whys Protocol, which included the following key components: 1) identifying specific problem statements based on the apparent violations listed above and related information obtained during the assessment of site activities; 2) asking the question "why did the problem occur" (and related "who", "what", "when" and "where" questions), and as many subsequent "why" questions as are required to identify the root cause or, in some cases, the root cause structure of the identified problems (i.e., the question "why" may be asked more or less than five times, as necessary). As appropriate for each problem statement, a 3-legged 5 Whys analysis was performed that included the following elements:

- Specific Whys, which were used for each problem statement;
- Detection Whys, which were used to understand the reasons why the previous or existing systems and procedures did not detect the problem; and
- Systemic Whys, which were used to evaluate the organizational or cultural reasons that resulted in an environment where the problem occurred.

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

The 5 Whys method identified contributing (i.e., causal) factors associated with the problem statements that, when integrated with the root cause and/or root cause structure, will allow HMC to identify appropriate countermeasures (i.e., corrective actions) associated with the five apparent violations. The corrective action plan document (not to be confused with the Groundwater CAP, which is due to NRC by the end of 2018) will be submitted to NRC within 60 days of this RCA Report, and will describe an implementation schedule, the methods to be used to evaluate the effectiveness of the individual corrective actions and a time frame or frequency for determining their effectiveness. The implementation schedule will include an effectiveness monitoring and reporting schedule to NRC, which is anticipated to vary depending on the problem-specific corrective action.

2.0 RCA Problem Statements and Findings

As described in Section 1, problem statements and findings are based on the apparent violations identified in the CO, and application of the RCA protocol through HMC investigations (document reviews and interviews). The following sections address each problem statement and identify the associated root cause (or root cause structure) and applicable contributory factors. Key causal factors are shown on attached fishbone diagrams for each problem statement. A summary for each problem statement describes the relationship, if any, among identified root causes.

2.1 Problem Statement No. 1

Problem Statement No. 1 is: "Implementation of The Reinjection Program in a Manner Inconsistent with the Groundwater Corrective Action Plan (CAP)".

The context for this problem statement is that the Reinjection Program implemented by HMC between 1995 and August 2016, and regulated by NMED, was determined by NRC to be inconsistent with the 1989 CAP. The Reinjection Program involved the collection of slightly contaminated alluvial groundwater from outside the zone of alluvial aquifer hydraulic containment followed by injection of that water back into the alluvial aquifer within the zone of hydraulic containment. Per the 1989 CAP, as modified by the Reverse Osmosis (RO) system in a January 15, 1998 submittal from HMC to NRC, only fresh water and RO-treated water meeting Site GWPS in License Condition (LC) 35B from License No. SUA-1471 were authorized by NRC for injection. The water used in the Reinjection Program did not meet these criteria.

HMC addressed the Reinjection Program in two proposed revisions updating the 1989 CAP (2006 and 2012), but those revised CAPs were not approved by NRC. When NRC performed a comprehensive review of Site compliance issues in 2015-16, near the end of the CAP update process, the Reinjection Program was identified as an apparent violation. Prior to that, the NRC had not identified the Reinjection Program as an issue.

This problem statement has led HMC to three Why analyses labeled A, B and C that, respectively, address Specific, Detection and Systemic Why analyses. Responses to questions associated with the initial "why" question are provided below:

- Who - HMC Site Managers, and NRC and NMED staff.
- When - from implementation of the Reinjection Program in 1995 through August 2016.

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

- How – The apparent use of “non-compliant” water in the program, non-alignment of NRC and NMED regulatory requirements, assumptions by the HMC staff regarding how NRC viewed the relationship between the NRC and NMED requirements coupled with insufficient communications between HMC Site Managers and NRC, and, in particular, HMC’s interpretation of an absence of NRC approval objections during audits and review of CAP update submittals.

Why Analysis A - Specific Root Cause

- 1 - Why was the Reinjection Program implemented in a manner inconsistent with the groundwater CAP?

HMC identified the reinjection program as a method to improve the efficiency of the groundwater remediation system, and incorrectly assumed, in the context of oversight by multiple federal and state agencies, that operation of the reinjection program in compliance with the NMED permit, DP-200, would suffice without amendment of the NRC CAP or approval by NRC.

- 2 – Why didn’t HMC check with NRC on the need to obtain approval of the reinjection system?

HMC incorrectly assumed that its obligation to obtain NRC approval was met by the fact that NRC was aware of the reinjection program through inspection audits and reports, as well as draft revised CAP submissions in 2006 and 2012 that described current remediation activities at the Site, including the reinjection program, and did not object to the program.

- 3 - Why wasn’t the issue regarding the non-compliance of the ongoing Reinjection Program identified and remedied during the CAP update process?

Specific Root Cause: HMC believed that the non-compliance issue during the CAP update process was not addressed primarily due to inadequate communications between HMC and NRC at the time. The revision and updating of the 1989 CAP has been a very long process involving the compilation of comments from multiple regulatory agencies and non-governmental organizations (NGOs) as well as multiple requests by NRC for HMC to supply additional information. Despite the fact that this process occurred over many years and involved the exchange of much information regarding the Site operations, the non-compliance of the ongoing Reinjection Program was not identified. HMC believed that the lack of identification of the program as non-compliant resulted from a lack of clear communication between HMC and NRC. Had this issue been identified in discussions of the revised CAPs, the Reinjection Program could have been approved or modified to be consistent with an updated CAP.

Why Analysis B - Detection Root Cause

- 1 - Why was the Reinjection Program implemented in a manner inconsistent with the groundwater CAP?

HMC believed the Reinjection Program was implemented in a manner that was consistent with NMED requirements as described in the 1995 and subsequent 2014 discharge DP-200 permits, and HMC assumed that compliance with NMED requirements would ensure consistency with the CAP.

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

- 2 - Why did HMC assume that achieving NMED requirements would ensure consistency with the CAP?

HMC believed that, because NMED was the lead regulatory agency for oversight of groundwater restoration operations at the Site, NRC did not need to explicitly approve of all modifications to the groundwater restoration program.

- 3 - Why didn't HMC understand its obligations to request and receive approval from NRC before making modifications to the groundwater restoration program that deviated from the 1989 CAP?

Detection Root Cause: HMC personnel did not understand the regulatory obligations and HMC's obligation, where necessary, to clarify the structure of the complex regulatory environment at the Site (e.g., in a formal written document), which would have allowed all parties to understand their roles and responsibilities in administering the groundwater restoration program. Managers subsequent to the manager at the time of program initiation assumed that ongoing programs at the time they took the position had been properly authorized, and did not take steps to confirm that authorization.

Why Analysis C - Systemic Root Cause

- 1 - Why was the Reinjection Program implemented in a manner inconsistent with the groundwater CAP?

HMC incorrectly assumed that, as long as changes to the groundwater restoration program improved performance of the remedy, it did not have to get approval of every change from NRC.

- 2 - Why did HMC assume that changes to the groundwater restoration program that improved remedy performance did not need NRC approval?

Although amended LC35 (License Amendment No. 5 dated March 19, 1990) required implementation of "the corrective action program described in the September 15, 1989 submittal," HMC assumed that any modifications to the groundwater restoration program described in the 1989 CAP would still be consistent with LC35 because it also stated that the program was to be implemented "with the objective of returning the concentrations of chromium, molybdenum, selenium, thorium-230, uranium, and vanadium to the concentration limits specified in Subsection (B)."

- 3 - Given the potential for misinterpretation of the requirements of LC35C, why didn't HMC clarify with NRC the degree of latitude it had to implement the groundwater restoration program?

HMC did not receive any feedback from NRC that the Reinjection Program constituted a violation of the License. HMC assumed that if there were compliance issues, NRC would bring them to the HMC's attention during Site inspections or other communication, and that the issues would be resolved (i.e., essentially, a misunderstanding of expectations by HMC).

Root Cause Analysis Report Homestake Mining Company of California - Confirmatory Order

4 - Why did HMC rely on a passive approach to ensuring compliance with the LC35?

Systemic Route Cause: HMC Site Managers were busy with other routine regulatory compliance, Site operations, personnel issues, and Site closure planning, etc., and failed to prioritize proactive communications with NRC about the Reinjection Program or other issues not identified by NRC (i.e., HMC did not recognize the need to allocate resources to the Site and/or prioritize communications with NRC to ensure full compliance with the License).

Summary of Problem Statement No. 1 Root Causes

The attached fishbone diagram for Problem Statement No. 1 includes four categories encompassing the root causes and contributory factors that include Communications, Regulatory Oversight, HMC Management and Inadequate Resources, which were identified in the Specific, Detection and Systemic analyses. Common factors throughout the root cause structure are poor communications between HMC and NRC as well as HMC's failure to establish protocols for ensuring full compliance in the complex regulatory environment, which resulted in HMC devoting inadequate resources at the Site for compliance-related matters. Communications between the Site Manager and corporate management may not have addressed sufficiently the ability of Site staff to simultaneously and adequately focus on compliance, closure progression and routine Site activities.

The inability of HMC and NRC to update the 1989 CAP over a nominal 20-year period also points to other contributory factors that include: 1) the regulatory overlap of NMED with authority over the Reinjection Program, which HMC appears to have relied upon to assume compliance with relevant LCs; and 2) HMC's assumption that an absence of NRC complaints would justify not ensuring that all water used in the Reinjection Program was compliant with all applicable LCs (and documents referenced therein) as well as with NMED groundwater protection standards.

2.2 Problem Statement No. 2

Problem Statement No. 2 is: "Discharge of Liquid Effluents at SP2 in Excess of the Site Groundwater Protection Standards (GWPS) Established in the License".

The context for this problem statement is that, during the period from 1999 through 2014, NRC identified a total of 67 monthly composite samples from SP2 that exceeded the applicable GWPS for uranium and/or molybdenum. Most of those exceedances were of more stringent standards in the License prior to the establishment of the current baseline standards set in 2006. SP2 is a monitoring point for injection water from the RO Plant (and other sources such as fresh water from the San Andres Glorieta [SAG] Aquifer wells) that was specified in LC35C (License Amendment 30). Per a February 19, 1998 TER provided by NRC, the purpose of SP2 was to ensure that GWPS were being met prior to injection of the treated water.

This problem statement has led HMC to three Why analyses (labeled A, B and C) that, respectively, include a Specific analysis, a Detection analysis and a second Specific analysis. Responses to the questions associated with the initial "why" question are provided below:

- Who - HMC Site Managers, HMC staff, HMC consultants, and NRC and NMED staff.
- When - from 1999 through 2014.

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

- How – Technical issues and reactionary maintenance, inadequate reporting, insufficient communications between HMC Site Managers and NRC, insufficient contingency planning, and License language ambiguity.

Why Analysis A - Specific Root Cause

- 1 - Why were liquid effluents at SP2 discharged at concentrations above the Site GWPS established in the License?

The RO Plant did not produce effluent with sufficiently low concentrations to meet Site GWPS¹, even after mixing with fresh SAG aquifer water.

- 2 - Why didn't the RO Plant consistently produce effluent with sufficiently low concentrations?

The original RO Plant experienced technical issues that included sand filter performance, backwash performance, and membrane fouling. The upgraded RO Plant experienced technical issues that included pump performance, backwash performance, control panel and sensor performance, heater performance, valve and seal leakage, actuator performance and membrane fouling.

- 3 - Why did the RO Plant experience these repeated technical issues?

Specific Root Cause: Because there was no preventative maintenance program for the original and upgraded RO Plants, the RO Plant would, on occasion, produce treated water with higher-than anticipated concentrations before corrective actions (e.g., adjustments, repairs or replacements) could be performed.

Why Analysis B - Detection Root Cause

- 1 - Why were liquid effluents at SP2 discharged at concentrations above the Site GWPS established in the License?

SP2 was not listed as a compliance point under LC35B, so HMC did not include SP2 as a reporting point and assumed that, based on improving alluvial aquifer conditions (i.e., lower concentrations), the occurrences of SP2 exceedances were not of significance to NRC. Specifically: 1) LC35B indicated that the constituents (selenium, uranium, molybdenum, sulfate, chloride, TDS, nitrate, vanadium, thorium-230 and radium-226 and 228) must not exceed the GWPS at three compliance wells (D1, X and S4); and 2) LC35C indicated that composite samples from SP2 will be taken monthly and analyzed for uranium and molybdenum (reporting requirements were not specified in these LCs).

- 2 - Why did HMC assume this?

NRC did not indicate any SP2 exceedance compliance issues during Site inspections or in Site inspection reports.

¹ Prior to 2006, both NRC and HMC recognized that the license standards could not be met, and the focus was on development of technically sound background standards.

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

3 - Why didn't HMC seek feedback from NRC regarding the injection of non-compliant water?

HMC, as noted, did not believe that SP2 was a compliance point under the License due to the wording of both LC35B (which lists compliance points and does not include SP2) and LC35C (which indicated the need for the collection of composite samples from SP2), and HMC did not specifically direct NRC to SP2 data during Site inspections or in semi-annual or annual reports.

4 - Why wasn't NRC able to determine if SP2 exceedances occurred?

Detection Root Cause: NRC was either not aware of the SP2 exceedances because HMC did not report them during inspections, or NRC staff had the same interpretation as HMC of ambiguous License language regarding SP2 reporting requirements.

Why Analysis C - Specific Root Cause

1 - Why were liquid effluents at SP2 discharged at concentrations above Site GWPS established in the License?

HMC was unable to monitor, troubleshoot and correct RO Plant performance in a timely manner before non-compliant water was injected.

2 - Why wasn't HMC able to perform these activities in a timely manner?

HMC staff did not have the training or procedures required to proactively troubleshoot or correct process engineering issues.

3 - Why didn't HMC provide Site staff with adequate training or procedures?

As noted above, HMC did not believe SP2 was a compliance point under the License, and therefore did not appreciate the importance of the SP2 discharge to License compliance. As a result, HMC did not allocate sufficient resources to staff technical training. Also, HMC did not provide appropriate training or procedures to staff to allow them to proactively manage RO Plant performance.

4 - Why didn't HMC understand the importance of RO plant compliance at SP2?

Specific Root Cause: SP2 was not specifically identified in the License as a point of compliance, nor was the 1998 TER incorporated by reference in the License Condition regarding SP2.

Summary of Problem Statement No. 2 Root Causes

The attached fishbone diagram for Problem Statement No. 2 includes five categories encompassing the root causes and contributory factors that include Regulatory Oversight, HMC Management, HMC Staff, Planning and Control, which were identified in the Specific, Detection and Systemic analyses. The three analyses form a primary root cause structure that includes technical and maintenance issues, and detection and reporting failures.

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

The fishbone diagram indicates that an insufficient focus on compliance by HMC Site Managers was a pervasive element of this apparent violation. HMC Site Managers did not believe the License required compliance and reporting at SP2, and thus did not dedicate sufficient resources to resolving RO Plant performance issues. Unclear and ambiguous language in the License was a contributory factor that led to HMC's misunderstanding of SP2 compliance obligations.

2.3 Problem Statement No. 3

Problem Statement No. 3 is: "Failure to Report to NRC the Results of all Effluent Monitoring Required by the License, specifically for SP1 and SP2", which is related to Problem Statement No. 4.

The context for this Problem Statement is the wording of License Condition 15 (LC15), which states:

The results of all effluent and environmental monitoring required by this License shall be reported to the NRC. For purposes of reporting requirements, only groundwater radionuclide data from the point of compliance wells and background well P shall be reported (Amendment 34, June 2002).

HMC complied with the requirement to report groundwater data from point-of-compliance (POC) wells (D1, S4 and X) and background well P in the semi-annual and annual monitoring reports, but did not include analytical data for sampling points SP1 and SP2 associated with the RO Plant.

This problem statement has led HMC to a single Specific Why analysis. Responses to questions that are associated with the initial "why" question are provided below:

- Who - HMC Site Manager and NRC.
- When - from the start-up of the RO Plant in July 1999 through the present.
- How - Ambiguous LC15 and LC35B/C compliance requirements and no indication of non-compliance for these reporting requirements in NRC annual inspection reports. As noted above for Problem Statement No. 2 - Why Analysis B: LC 1) LC35B indicated that select constituents must not exceed the GWPS at three compliance wells (D1, X and S4); and 2) LC35C indicated that composite samples from SP2 will be taken monthly and analyzed for uranium and molybdenum.

Why Analysis A - Specific Root Cause

1 - Why did HMC fail to report effluent monitoring results from sampling points SP1 and SP2?

HMC interpreted LC 15 ("for purposes of 10 CFR 40.65 reporting requirements...only data from point of compliance wells and well P shall be reported"), to mean that only the analytical results for the designated wells were to be reported.

2 - Why did HMC assume that the intent of LC15 was to only report the analytical results for the designated wells and not the sample results from SP1 and SP2?

Although the language in LC15 appeared to be ambiguous by stating that "all effluent" shall be reported and "for purposes of reporting requirements, only groundwater radionuclide

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

data from POC wells and Well P shall be reported", HMC believed that only the second part of LC15 was the applicable requirement for License compliance.

- 3 - Why did HMC believe that the second part of LC15, up through and including License Amendment 48, was the only compliance reporting requirement, while the first part of LC15 mandated reporting of all information generally?

HMC assumed that, because the NRC annual inspection reports up to the 2016 report (associated with the 2015 inspection), indicated HMC was compliant with LC15 reporting requirements, HMC's interpretation of the LC15 reporting requirement was correct.

- 4 - Why, during the approximate 18-year reporting period, did HMC not confirm with NRC that this interpretation was the correct one?

Specific Root Cause: The HMC Site Manager did not believe such communications between HMC and NRC during annual Site inspections were necessary given prior inspection reports. Until NRC commenced its investigation of facility compliance in mid-2015, HMC had no reason to anticipate that NRC would have a different interpretation of LC15.

Summary of Problem Statement No. 3 Root Causes

The attached fishbone diagram for Problem Statement No. 3 includes three categories that encompass the root causes and contributory factors that include Communications, HMC Management and Regulatory Oversight. HMC did not completely understand the requirements of the LC due to unclear or ambiguous language. In addition, HMC did not clarify the LC requirements with NRC, nor did the reporting issues come up during the many years of NRC compliance audits, which reinforced HMC's belief that it was reporting correctly. Communications between HMC and NRC were insufficient to proactively address this problem during Site inspections and, subsequently, within annual inspection reports.

2.4 Problem Statement No. 4

Problem Statement No. 4 is: "Failure to Obtain Monthly Composite Samples as Required by the License, specifically for SP1 and SP2", which is related to Problem Statement No. 3.

Because Problem Statement No. 4 references two different sampling points (SP1 and SP2), each sampling point is addressed with a separate Why analysis. The context for SP1 includes the following: 1) although LC35C in License Amendment 30 specifically mentioned the collection of monthly composite samples from SP2, the LC 35C reference to a January 15, 1998 HMC submittal did not also include a reference to the February 19, 1998 TER provided by NRC that specifically addressed sampling at SP1; 2) HMC assumed that sampling of SP1 was primarily intended for managing RO Plant operations, and did not understand that SP1 sampling was included in the long-term effluent monitoring program described in the TER; and 3) NRC annual inspection reports did not indicate any compliance issues associated with HMC not collecting monthly (or quarterly) composite samples from SP1. During its review of Site compliance issues, NRC noted that SP1 had been sampled 0 times between 1999 and 2014. The context for SP2 is that, from 1999 through 2014, a total of 10 monthly composite samples were not collected from SP2.

This problem statement has led HMC to two Specific Why analyses labeled A (SP1) and B (SP2). The B analysis has Detection and Systemic elements that are not specifically addressed in a Why analysis, but are represented on the fishbone diagram. Responses to questions associated with the initial "why" question are provided below:

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

- Who - HMC Site Manager, Site staff and NRC.
- When - from the start-up of the RO Plant in July 1999 through March 2015.
- How - For A, insufficient communications between the HMC Site Manager and NRC regarding LC35C compliance requirements, and no feedback from NRC regarding non-compliance for these reporting requirements in NRC annual inspection reports. For B, human error and lack of quality management oversight, and/or written procedures.

Why Analysis A - Specific Root Cause

- 1 - Why was there a failure to collect composite samples from SP1?

HMC did not completely understand the requirements of LC35C, which only specifically listed sampling requirements for SP2 and, therefore, HMC only collected a limited number of SP1 samples during the RO Plant start-up period. Subsequently, HMC sporadically collected 20 samples from SP1 through 2011 as part of RO Plant operations and maintenance (O&M), which were not intended for compliance purposes.

- 2 - Why didn't HMC completely understand the requirements of LC35C?

HMC failed to understand that NRC's TER dated February 19, 1998 responding to the 1998 HMC submittal (referenced in LC 35C), which specified SP1 monitoring and the potential basis for decreasing the frequency of SP1 monitoring, was an obligation of LC35C. The TER stated that:

Composite samples from SP1 will be taken monthly for the first year of operation ... the decrease in sampling is dependent on demonstrating acceptable levels of constituents before decreasing sampling frequency.

- 3 - Why didn't HMC request a decrease in SP1 sampling frequency pursuant to the TER?

HMC incorrectly assumed that it was not required to affirmatively seek NRC approval of reduced SP1 sampling, and that SP2 sampling and groundwater sampling of the alluvial aquifer were sufficient to achieve compliance with the License.

- 4 - Why did HMC make this assumption?

The HMC Site Manager assumed that HMC did not require specific NRC approval to implement changes based on decreasing constituent levels in the alluvial aquifer and SP2 analytical data. In addition, HMC believed that the effluent monitoring program without SP1 data was compliant with LC35C (i.e., SP1 sampling was to be used only for RO Plant O&M).

- 5 - Why did HMC continue to believe that the effluent monitoring program was compliant with LC35C?

Specific Root Cause: HMC did not recognize NRC's intent for SP1 sampling as presented in the TER (i.e., HMC inaccurately believed that SP1 sampling was only a plant start-up requirement and an as-needed O&M activity) because the TER was not incorporated by reference in LC 35C.

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

Also, because NRC did not indicate non-compliance with LC 35C in annual inspection reports, HMC continued to assume the effluent monitoring program was acceptable to NRC. HMC did not recognize the program as a potential compliance issue until a Request for Information from NRC dated March 16, 2015 was transmitted to HMC.

Why Analysis B – Specific Root Cause

- 1 - Why was there a failure to collect all monthly composite samples from SP2 during the period from 1999 through 2014 (specifically, why were 10 monthly composite samples not collected during this period)?

HMC located nine of the 10 reported-as-missing samples, as documented in Site records (FORM-21 – Analytical Sheet) for the nine samples (laboratory reports for the nine samples were located from Site files and from the records of the third party analytical laboratory [Energy Labs] used to analyze the samples). No record of a composite SP2 sample being collected in June 2004 could be found in any on- or off-Site records or database, which could have resulted from human error or the inability to collect a sample during a period when the RO Plant was not in operation. Of the nine SP2 composite samples with analytical results, eight samples had analytical results that complied with License-specified standards.

- 2 - Why were the analytical results for the nine collected samples not entered into the Site database and a 10th sample not collected?

It appears that these routinely performed tasks were overlooked by a staff person, and were not double-checked by another staff person with quality control (QC) responsibilities to confirm that the data entry and sample collection processes were completed.

- 3 - Why were these routine tasks overlooked and not double-checked?

Specific Root Cause: HMC did not have QC procedures in place to ensure that all collected samples with laboratory analytical results were properly entered into the Site database or that all samples were collected.

Summary of Problem Statement No. 4 Root Causes

The attached fishbone diagram for Problem Statement No. 4 identifies four categories that encompass the root causes and contributory factors that include Communications, HMC Management, HMC Staff and Regulatory Oversight. HMC failed to: 1) understand License requirements; 2) provide or enforce QC and data management procedures; and 3) provide or allocate adequate resources to perform compliance-related tasks. Communications between HMC and NRC were insufficient to address this problem during Site inspections and inspection reports. HMC did not completely understand the LC requirements due to: 1) to HMC's failure to proactively incorporate the TER information provided by NRC; and 2) the absence of a specific reference in the LC to the TER.

2.5 Problem Statement No. 5

Problem Statement No. 5 is: "Discharge of Liquid Effluents Containing Byproduct Material to Land Application Areas without First Obtaining NRC Approval".

Root Cause Analysis Report

Homestake Mining Company of California - Confirmatory Order

The context for this problem statement is that the land application program was not initially permitted by NMED because: 1) the alluvial groundwater was to be used for irrigated agriculture; and 2) the low-level concentrations identified in the groundwater did not exceed concentrations for uranium and selenium that were established by NMED for irrigation at that time (February 15, 1999 letter from NMED to HMC and Appendix A to HMC's 1999 irrigation evaluation report). In a letter from NRC to HMC dated April 20, 1999, NRC indicated that the land application program was not subject to regulation by the NRC in conjunction with Materials License SUA-1471.

In 2009 (February 20, 2009 letter from NMED to HMC), NMED raised concerns with the land application program because New Mexico groundwater standards had been revised and the quality of the land application water exceeded the new standards. HMC continued to operate the land application program, with modifications to address NMED's concerns (NMED issued annual Conditional Temporary Permission for the program in 2010, 2011 and 2012), until 2012 when the program was terminated. During this time, HMC assumed that the land application program was conducted in compliance with NMED requirements. In addition, during the entire period of operation of the land application program, HMC incorrectly assumed that irrigation supply water containing low-level residual uranium did not contain radioactive byproduct material as defined in Section 11(e).2 of the 1954 Atomic Energy Act.

This problem statement has led HMC to three Why analyses (labeled A, B and C) that, respectively, address Specific, Detection and Systemic Why analyses. Responses to questions associated with the initial "why" question are provided below:

- Who - HMC Site Manager, NRC and NMED.
- When - From 2000, when the Land Application Program was initiated, to 2012 when the program was terminated.
- How - Inadequate communications between HMC, NRC and NMED regarding the land application program; non-alignment of NRC and NMED regulatory requirements; the failure to recognize that the supply well water, which had elevated uranium levels, could potentially contain byproduct material; and an insufficient focus by HMC on compliance.

Why Analysis A

- 1 - Why were liquid effluents containing byproduct material discharged to land application areas without first obtaining NRC approval?

HMC had requested approval of the program from both NMED and NRC, and had been told that neither agency had regulatory authority over discharges to the land application areas.

- 2 - Why did HMC assume that NRC approval was not required?

NRC indicated in a letter dated April 20, 1999 that the proposed land application program did not appear to be subject to regulation by the NRC in conjunction with the License.

- 3 - What reason did the NRC provide in concluding that the proposed land application program did not appear to be subject to regulation by the NRC?

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

In a letter dated February 16, 1999, while HMC did not specifically state that the water might include byproduct material as defined in Section 11(e).2 of the 1954 Atomic Energy Act, HMC informed NRC that the irrigation program would use water from "Homestake property" and that the "water contains some residual low level contamination." The NRC then concluded that the irrigation program was not subject to NRC jurisdiction.

- 4 - After NMED raised issues regarding the land application program to HMC in a letter dated February 20, 2009, why didn't HMC inform NRC that the irrigation water could potentially contain byproduct material and that the land application program could be subject to NRC approval?

HMC continued to assume that the land application program remained compliant with NRC requirements as long as NMED groundwater protection standards were achieved, and thus HMC continued to operate the land application program with the modifications to address NMED's concerns².

- 5 - Prior to the termination of the land application program in 2012, why didn't HMC recognize that the program may have potentially contained byproduct material and inform NRC?

Specific Root Cause: HMC failed to understand the appropriate definition of byproduct material.

Why Analysis B

- 1 - Why were liquid effluents containing byproduct material discharged to land application areas without first obtaining NRC approval?

HMC's submittal of the land application Notice of Intent (NOI) to NMED indicated that the source of irrigation water was: 1) below background "State site standards" for uranium and selenium; and 2) assumed to be outside of the plume of contamination and outside the area of influence of the ground water remediation system. Based on this information, NMED responded to HMC in a letter dated February 15, 1999 that a discharge permit was not required because of the irrigation water characteristics provided by HMC. NMED's approval reinforced HMC's understanding that NRC approval of the land application was not necessary.

- 2 - Why did HMC continue to assume that NRC approval was not necessary after NMED issued its 2009 letter to HMC and, subsequently, after NMED required a discharge permit (DP-200)?

In response to the 2009 NMED letter, HMC focused its attention on understanding the vadose zone and groundwater conditions in the land application areas, and did not consider a potential connection between these areas and the upgradient portion of the alluvial aquifer within the NRC License boundary, which was known to contain byproduct material.

² Pursuant to the NMED 2009 letter, HMC: 1) eliminated three of the four irrigated parcels with the intent of meeting more stringent State-wide groundwater protection standards that were implemented by NMED in 2007; 2) continued land application in only one parcel; and 3) implemented vadose zone characterization activities to evaluate concentrations of chemicals in soil and groundwater in the land application area.

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

- 3 - Why didn't HMC investigate this potential connection, which may have indicated that the alluvial water supply wells for the land application program contained residual byproduct material?

Detection Root Cause: HMC did not detect this potential connection because of its original understanding of the presence of low-level concentrations of uranium in the alluvial aquifer and, after receipt of the NMED 2009 letter with new discharge permit and temporary authorization requirements, its focus was on remaining in compliance with NMED requirements under DP-200 rather than reconfirming whether NRC approval of the program was required.

Why Analysis C

- 1 - Why were liquid effluents containing byproduct material discharged to land application areas without first obtaining NRC approval?

HMC recognized that the alluvial aquifer that supplied irrigation water to the land application areas contained low level concentrations of uranium, but did not recognize the potential for that to represent byproduct material from the NRC License area.

- 2 - Why didn't HMC recognize that the irrigation water could have contained byproduct material?

HMC did not sufficiently investigate the potential connection between the land application areas and the alluvial aquifer within the NRC License area.

- 3 - Why didn't HMC adequately investigate the potential relationship between the sources of alluvial water used in the land application program and the contamination in the alluvial aquifer beneath the upgradient NRC License area?

Systemic Root Cause: HMC did not fully understand its compliance obligations and therefore did not sufficiently investigate this potential relationship in addition to compliance with NMED regulatory requirements under DP-200 that included extensive meetings, development of temporary authorizations and the development of a closure plan for the land application areas.

Summary of Problem Statement No. 5 Root Causes

The attached fishbone diagram for Problem Statement No. 5 includes four categories encompassing the root causes and contributory factors that include Communications with NRC, Regulatory Oversight, HMC Management and Planning. In addition to the general HMC management issues shown on the diagram, HMC failed to recognize that the source water from the alluvial aquifer may have contained byproduct material, and did not proactively plan for this potential occurrence. It was not until community action groups raised concerns about environmental effects of the land application program to NMED that HMC and NMED considered such effects in their planning. However, up until its termination in 2012, the land application program was conducted in compliance with NMED requirements. The three root cause analyses form a root cause structure that indicates inadequate recognition by HMC of the potential issues created by the program; infrequent and/or inconsistent communications between HMC, NRC and NMED; and the failure by HMC to detect potential byproduct material in the land application water.

**Root Cause Analysis Report
Homestake Mining Company of California - Confirmatory Order**

3.0 RCA Summary

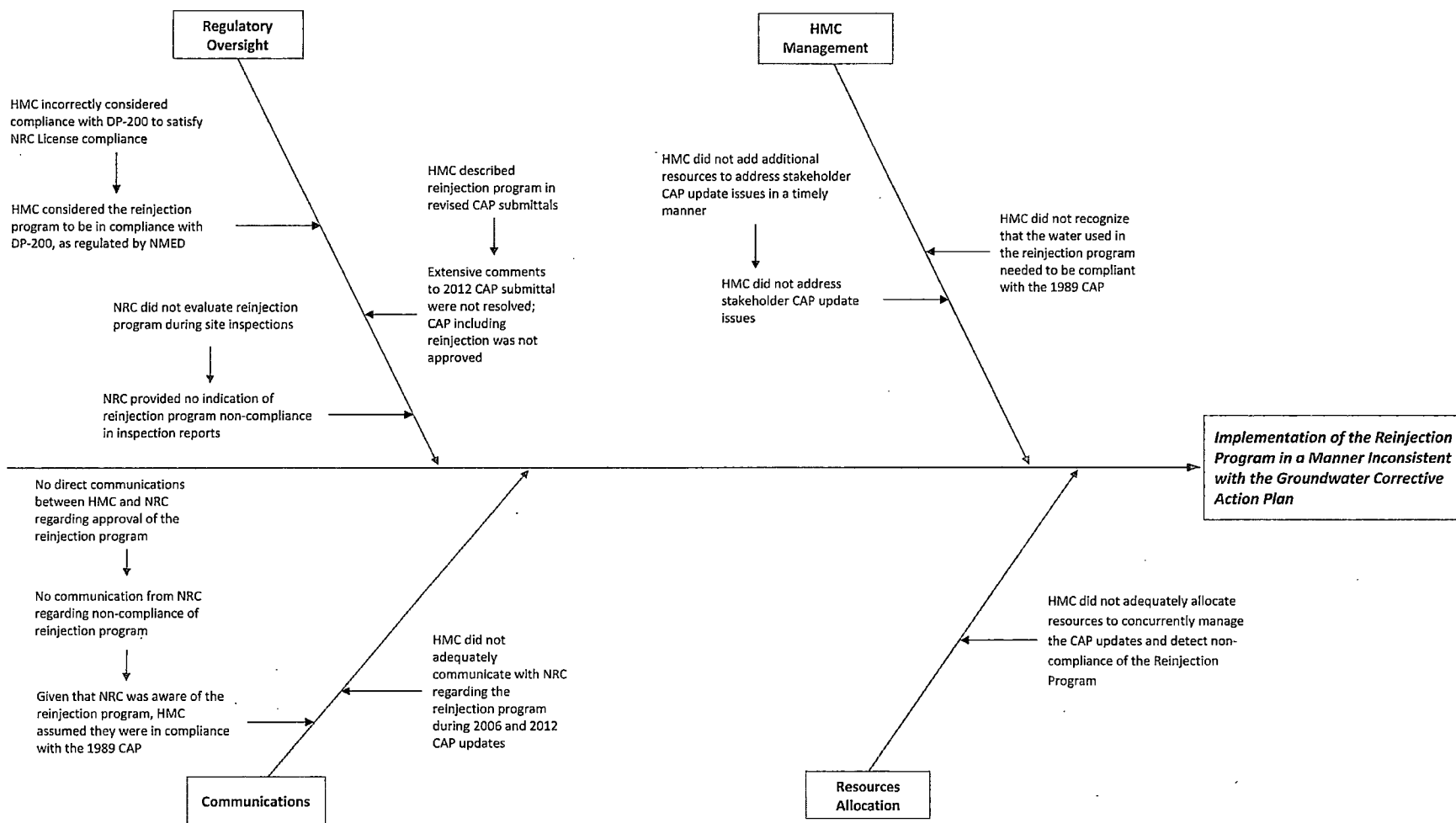
The findings presented in this RCA Report indicate that the following seven categories encompass the root causes and contributing factors for the five apparent violations in the CO (the number in parentheses is the number of times each category appears on the five attached fishbone diagrams):

- | | | |
|----------------------------|----------------------|----------------------------|
| • HMC Management (5) | • Communications (4) | • Control (1) |
| • Regulatory Oversight (5) | • HMC Staff (2) | • Inadequate Resources (1) |
| | • Planning (2) | |

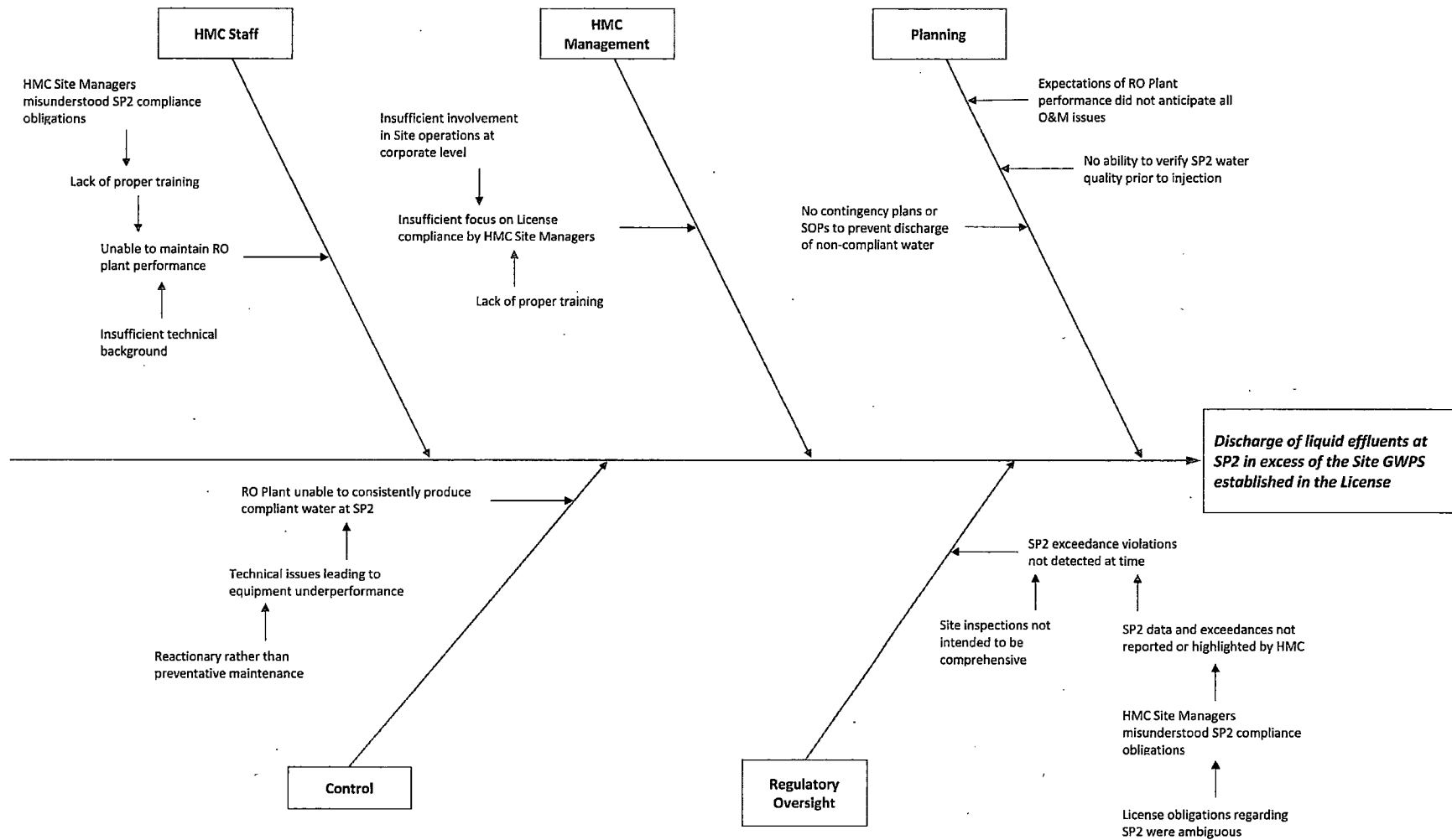
The tip of the root cause structure is clearly HMC Management (Site and, to a lesser extent, corporate) because, as the Licensee, HMC was ultimately responsible for License compliance associated with discharge-related activities and proactively communicating with NRC and other regulatory agencies regarding Site activities and compliance with all applicable federal, state and local regulations. An integral element of the root cause structure was apparent limited communications between the Site Manager and: 1) corporate personnel regarding compliance, resource needs and Site closure progression; and 2) Site staff regarding Planning and Control functions needed to support routine remediation and water management activities and compliance with License requirements.

The Regulatory Oversight category includes: 1) HMC's misunderstanding of License and CAP requirements, often based on unclear License language; and 2) the absence of complete and timely feedback to HMC from NRC on potential License compliance issues. NRC's role in this category was a contributing factor particularly in the context of NUREG/BR-0256 mandates for efficiency (i.e., "best possible management and administration" from NRC with the "highest technical and managerial competence"), clarity (i.e., "Agency positions should be readily understood and easily applied") and reliability (i.e., "regulation should be perceived to be reliable not unjustifiably in a state of transition") since the obligation for License and CAP compliance rested squarely on the Licensee. Planning and Control functions for License and DP-200 compliance were either not in place or, if in place, were not re-assessed and improved frequently enough to prevent the apparent violations described in the CO.

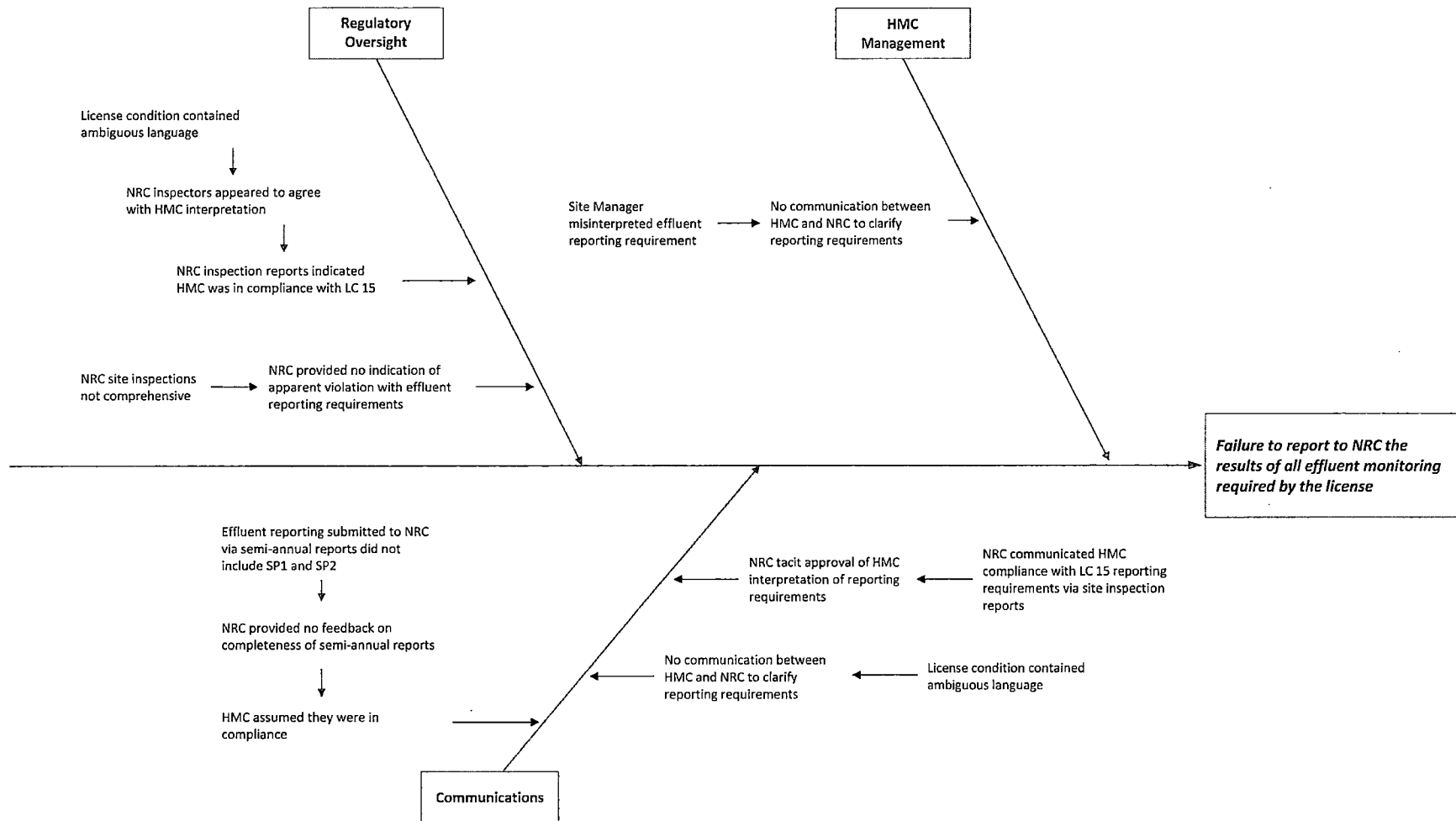
Problem Statement No. 1 – Fishbone Diagram



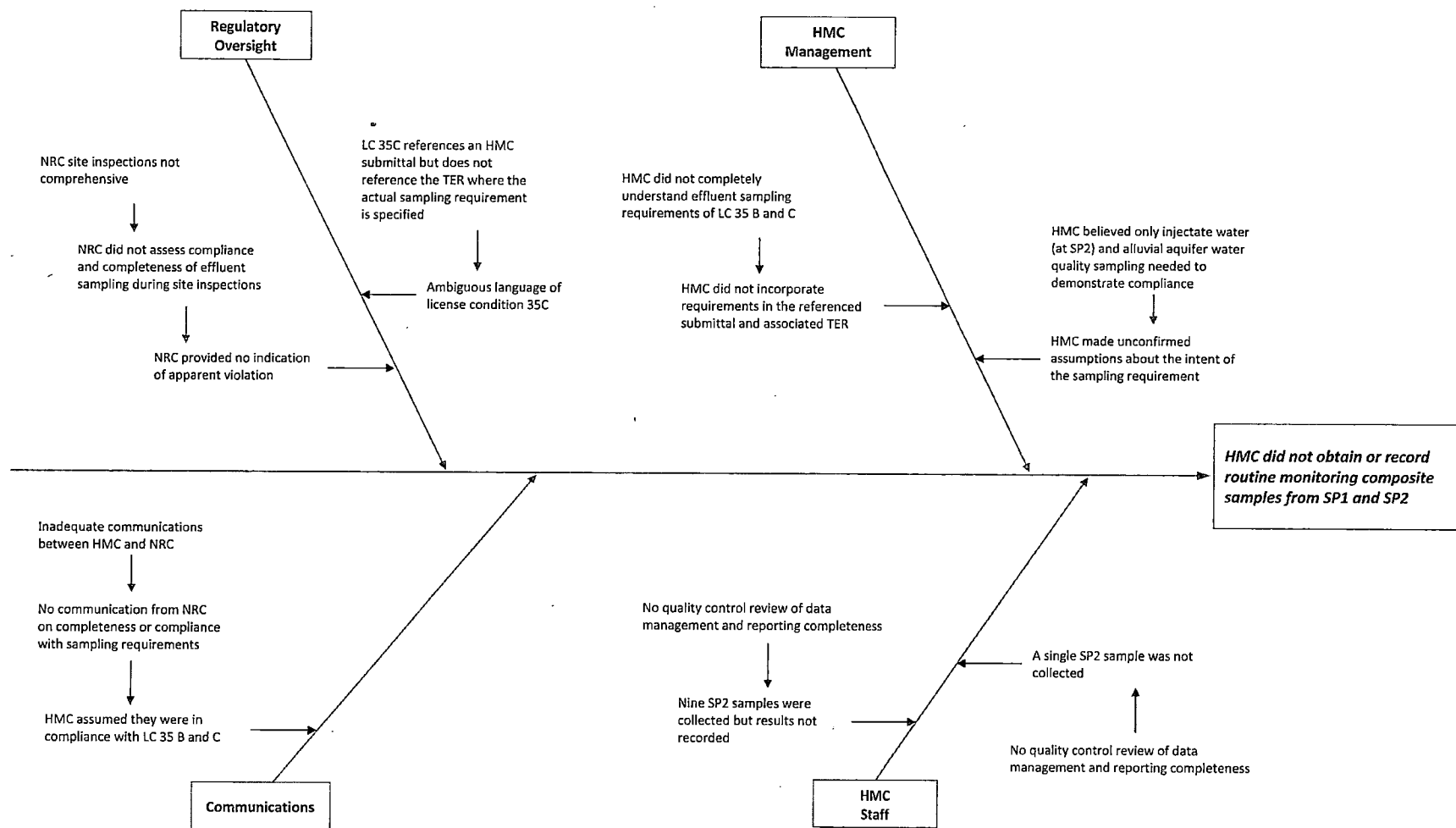
Problem Statement No. 2 – Fishbone Diagram



Problem Statement No. 3 – Fishbone Diagram



Problem Statement No. 4 – Fishbone Diagram



Problem Statement No. 5 – Fishbone Diagram

