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Environmental Management System Risks and Opportunities:

A Case Study in Pertamina Geothermal Energy Area Kamojang

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ABSTRACT

The Kamojang field is the first operating geothermal field in Indonesia, and is currently operated by Pertamina Geothermal Energy (PGE) Area Kamojang. PGE Area Kamojang has been implementing an environmental management system (EMS) according to the ISO 14001 Standard since 2002. The Standard is currently undergoing an extensive revision for 2015, including a new concept of "risks and opportunities that need to be addressed" to ensure the EMS can achieve its intended outcomes. This case study examines and explores the implications, strengths and weaknesses associated with several potential approaches for addressing this new concept. The methodologies provide for enhanced consideration of the organization's internal and external context, environmental conditions capable of affecting or being affected by the organization, and the needs and expectations of interested parties in order to determine actions needed to address risks and opportunities that can affect its EMS.

1. INTRODUCTION

Since its introduction in 1996, the international standard for environmental management system ISO 14001 has been widely accepted by organizations as a system to improve performance in terms of waste reduction, quality improvement, as well as cost reduction (Melnyk, Sroufe, and Calantone 2003, 344). This standard has been accepted by companies in developed countries and developing countries alike due to its perceived benefits. Although there is still an argument on the benefit of implementing ISO 14001 on financial performances, current research has mainly agreed to other benefits as mentioned above, and this has been is sufficient as a motivator for companies to adopt the standard in its management system (Tarí, Molina-azorín, and Heras 2013, 297, Montabon, Sroufe, and Narasimhan 2007, 1009, Darnall, Henriques, and Sadorsky 2008, 368, Nawrocka and Parker 2009, 604).

The benefit of the implementation of ISO 14001 in PGE Area Kamojang has been viewed positively by the management, and the organization gradually evolved its approach into an integrated management system, incorporating quality management according to ISO 9001 in 2006, and occupational, health and safety management according to OHSAS 18001 in 2009. This evolution was internally-driven since there was no external pressure to adopt these standards. Other benefits that PGE Area Kamojang received from the implementation of an integrated management system especially with ISO 14001 were recognition for environmental performance from the Indonesia Ministry of Environment in the form of the Gold PROPER award. This award is given to companies that have proven environmental performance and social responsibility. It is an instrument developed by the Ministry of Environment to encourage companies to comply with environmental regulations through informing the public about companies' environmental performance. The companies who are not in compliance are given a Black or Red PROPER rating, while companies in compliance are given Blue PROPER rating, whereas beyond compliance companies are given Green or Gold PROPER rating with Gold being the highest rating.

The ISO 14001 standard is reviewed and revised periodically, with its first revision published in 2004 and it is currently undergoing its second revision by The Environmental Management System Subcommittee (SC1) under ISO Technical Committee 207. The revision will include some new concepts and requirements that ISO is applying to all types of management system standards, including the concepts of "risks" and "opportunities" (in an organization) that need to be addressed in order to achieve the intended outcomes of the management system and prevent undesired effects. This new revision is planned to be launched in 2015.

This paper will focus specifically on these new concepts for the revision of ISO 14001. By applying these concepts to a mature EMS such as that of PGE Area Kamojang this work will provide insights on implementation of these concepts for existing users of the Standard.

2. BACKGROUND AND LITERATURE REVIEW

2.1 The Kamojang Geothermal Field

PT. Pertamina Geothermal Energy (PGE) Area Kamojang as a subsidiary of PT. Pertamina (Persero) adopted ISO 14001 to its operation in 2002. PGE Area Kamojang has been operating the kamojang geothermal field since 1983 as the first producing geothermal field in Indonesia. Its initial production was 30 Megawatts of electricity (MWe), with the power plant owned and operated by PT. Indonesia Power (IP), a subsidiary of PT. Perusahaan Listrik Negara (PLN), and PGE Area Kamojang as the supplier of geothermal steam through a steam sales contract. The geothermal field has been gradually developed with the same scheme reaching a total of 140 MWe in 1988 by adding two additional turbines, 55 MWe each operated by PT. IP. The Kamojang Geothermal Field has expanded the production by adding another 60 MWe in 2008 where PT. PGE decided to do a more comprehensive project scheme, in which it developed the steam field in combination with the power plant and made an electricity sales contract with PT. PLN. Currently there is a development of adding another 30 MWe to the existing 200 MWe total output from the Kamojang Geothermal Field which is planned to become commercial in 2015.

2.2 Environmental Management System (EMS)

Environmental management systems (EMS) historically developed from various sources. Many different trade associations in the U.S. developed EMS standards such as the Responsible Care program of the American Chemistry Council, the Sustainable Forestry Initiative of the American Forest and Paper Association, the Business Charter for Sustainable Development by firms affiliated with the International Chamber of Commerce, the sustainability-based principles of the Coalition for Environmentally Responsible Economies (CERES) and other EMS guidelines developed by trade associations in the petroleum, textiles, and chemical distribution industries (Coglianese and Nash 1997, 4). The gaining awareness about the importance of environmental protection was discussed in a global scale at the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro, Brazil in June 1992. One of the outcomes of this conference was to ask the International Organization for Standardization (ISO) to consider developing voluntary international environmental management standard. ISO responded to this request by launching ISO 14001 Environmental management systems - Specification with guidance for use, the first series of ISO 14000 International Environmental Management Standards in September 1996 (Morelli 1999, 6).

ISO 14001 specifies the design criteria for an environmental management system but is not a performance standard. It is intended to improve an organization's environmental performance through development and implementation of an environmental policy and objectives, taking into account legal and other requirements the organization subscribes to, and controlling and reducing the organizations significant impacts on the environment. It does not have any absolute environmental performance requirements that have to be fulfilled, but does require monitoring of performance in relation to significant environmental impacts and environmental objectives, and evaluation of compliance with legal and other requirements applicable to the organization(ISO 2004b, 1).

Since its introduction, ISO 14001 has been widely accepted by industry due to its implementability to all industries and countries. This gives ISO 14001 the potential to affect more firms globally than any other environmental certification program (Darnall 2006, 375). Until the end of December 2012, 167 countries have had organizations certified to ISO 14001, with at least 285,844 ISO 14001:2004 certificates issued, even more organizations implemented ISO 14001 without certifying them (ISO 2012, 2, Coglianese and Nash 1997, 4-5).

The implementation of an EMS such as ISO 14001 is critical for environmental management since companies that implement ISO 14001 improves their internal environmental management process which will improve their overall performance while reducing the potential of environmental damage (Seiffert 2008, 1459).

2.2 Benefits of Implementing EMS

There has been considerable research carried out to assess the benefits of implementing an EMS. The level of implementation can range from a formal EMS referring to ISO 14001 or other systems such as the European Union Eco-Management and Audit Scheme (EMAS), a formal EMS with certification to either ISO 14001 or EMAS, or even partial implementation of an EMS standard. The ISO 14001 standard states that the standard is applicable to any organization that intends to use the standard to improve its EMS, show conformance with its environmental policy or demonstrate conformity with the ISO 14001 standard through self-declaration or other parties. (ISO 2004a, 1):

Benefits of a formal EMS range from cost reduction, quality improvements, waste reduction, and better efficiency (Melnyk, Sroufe, and Calantone 2003, 344). A literature review of the benefits in implementing a quality and environmental management system concludes that the most analyzed benefits are improved efficiency and profitability, improved customer satisfaction, a better relationship with staff and improved company image (Tarí, Molina-azorín, and Heras 2013, 307). ISO 14001 certified companies overall demonstrated a higher engagement in environmental programs than the ISO 14001 non-certified companies (Naudé et al. 2012, 51). Although there are still debates on whether or not ISO 14001 has an effect on financial performance (Tarí, Molina-azorín, and Heras 2013, 307), it is without doubt that a formal EMS adoption such as laid out in ISO 14001 provides companies a guideline for operating more efficiently through reducing the adverse environmental impacts of the operations from waste reduction and pollution prevention (Rondinelli and Vastag 2000, 509). Companies also use ISO 14001 to gain more strategic value of their existing resources and capabilities to increase their competitive advantage (Darnall 2006, 375). A recent global survey done by the ISO/TC 207/SC 1 Ad-hoc Group (AHG) to nearly 5000 respondents from 110 countries in 2013 concluded that organizations implementing ISO 14001 realized significant value in meeting legal requirements, improving environmental performance, and enhancing management commitment and stakeholder engagement (ISO 2014, 3).

Despite the benefits supporting the adoption of ISO 14001 by companies, there are some criticisms about ISO 14001 certification since it does not measure nor ensure improved environmental performance and doesn't give any guarantee that a certified company will always remain in compliance with governmental regulations. Therefore the adoption of an EMS alone is not a panacea for achieving environmental sustainability (Rondinelli and Vastag 2000, 508-509).

2.3 Changes Expected in the ISO 14001 Second Revision

The second revision of ISO 14001 is currently underway and the ISO technical committee has mandated WG 5, the working group responsible for the revision process to carry out three significant actions (Briggs 2012):

1. Adopt the High Level Structure for Management System Standards (MSS) that has been issued by the ISO Technical Management Board (TMB) Joint Technical Coordination Group (JTCG) covering identical text, common terms and core definitions.
2. Take into consideration the final report of the ISO/TC 207 SC 1 on future challenges of EMS which evaluated the potential implications of evolving stakeholder expectations and new developments in the field of EMS since 1996.
3. Maintain and improve the basic principles and existing requirements of ISO 14001:2004.

The main goal of the high level structure is to standardize the structure and core requirements of MSS to enable multiple MSS integration into an organization's management system.

Some new requirements to ISO 14001 as a result of the high level structure are the understanding of the organization and its context, and understanding the needs and expectations of interested parties. This will require the organization to evaluate external and internal issues that might affect the organizations' EMS (Briggs 2012, 27). To help define the context of the organization and show where risk management can be utilized to improve a sustainability program, it is suggested that organizations create an organizational profile. This will enable them to develop programs based on their current profile aligning it with their internal and external context that will reduce overall risks to achieve its long term sustainability goals. The profile will be evaluated continually along with the internal and external risks, goals and objective to improve their profile over time based on the plan-do-check-act framework (Pojasek 2013, 92). The result of this evaluation is to determine the risk and opportunities associated with these issues that needs to be addressed to ensure that the EMS can achieve its desired outcome, prevent or reduce undesired effects, or to achieve continual improvement (Briggs 2012, 27).

2.4 Risk Evaluation

In the EHS field, risk has various definitions. The Occupational Health and Safety Assessment Series (OHSAS) 18001 which is an international standard for occupational health and safety (OHS) management system structured in parallel to ISO 14001 defines risk as "combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s)" (BSI 2007, 4). Other OHS management system standard such as the ANSI/AIHA OHS Management System Z10-2012 also defines risk in terms of a combination of the likelihood of a hazard and severity of injury or illness caused by the event.

From an environmental context, the United States Environmental Protection Agency (US-EPA) defines risk to be "the chance of harmful effects to human health or to ecological systems that is caused by an exposure to an environmental stressor". A stressor is "any physical, chemical, or biological entity that can induce an adverse response". Risk assessment is "a scientific process to characterize the nature and magnitude of health risks to humans and ecological receptors from chemical contaminants and other stressors that may be present in the environment" (US-EPA).

The ISO 31000 standard on risk management defines risk as: "the effect of uncertainty on objectives". This definition in general has been criticized for not being able to provide a clear meaning and makes different interpretations possible. This leads to the inability to establish a consistent conceptual framework for risk assessments and risk management (Aven 2011). The definition of risk has been generalized by ISO through the launch of Annex SL in 2012 which is the ISO management system standard "template". This means that all management system standards will follow the high level structure, identical core text, common terms and core definitions defined in Annex SL which is intended to make it easier for users of ISO standards to integrate different management systems. In Annex SL, risk is defined as "effect of uncertainty" with some notes accompanying the definition. One important note is that risk is often expressed as a combination of the consequences of an event and the associated likelihood of occurrence (ISO/IEC 2014, 127-128). This definition is the one used in the ISO 14001 committee draft 2.

In the methods discussing about risk assessment used in occupational health and safety management, all risk assessment methods have common fundamental elements (Main 2004, 47):

- Hazard identification
- Risk assessment
- Risk reduction
- Documentation of the results

The goal of the risk assessment process it to achieve acceptable risk through actions that would reduce the risks with considerations given to cost, feasibility and the ALARP (as low as reasonably practicable) framework (Main 2004).

An example of comparing the terms used in risk assessment methods to environmental management can be shown below (Labodová 2004, 576):

- Register of environmental aspects = sources of hazard
- Environmental impacts = consequences
- Environment = targets
- Significance of aspects = risk, acceptability

The concept of risk that is introduced in this revision of ISO 14001 is general and consistent with the definition already in use by EHS professionals when taking into account the notes accompanying the definition. Adopting the common definition of risk that involves probability/likelihood and severity can be used in the evaluation of environmental aspects. The evaluation of environmental aspects using the risk assessment process should be aligned with the organization's context to capture the culture, processes, structure and strategy of the organization (Pojasek 2013, 85). To systematically analyze their context, organizations can use the Badlrige Performance Excellence Framework organizational profile which has been widely used by organizations to address the organization's operating environment, its key relationships, its competitive environments and strategic context, and its approach to continual improvement (Pojasek 2013, 86-87).

Adopting the risk classification for the evaluation of environmental impacts allow the user to classify environmental impacts according to quantitative and/or qualitative scales (hierarchical or binary) or by value categories (relevant, very relevant and not very relevant). Whatever the type of methodology either qualitative or quantitative, the context of the organization must be taken into consideration to assure that the environmental impact evaluation is effective (Seiffert 2008, 1456).

3. METHODOLOGY

This case study examines PGE Area Kamojang's current approach for identifying and prioritizing its environmental impacts and explores the implications, strengths and weaknesses associated with several potential approaches for addressing the new concept. The process of analyzing the implementability of the new requirements presented in the standard draft involved defining the context for the case study organization, PT. PGE Area Kamojang. Existing management system documents were utilized to gather information about current issues that may affect the environmental management system, interested parties identified through social mapping and internal procedures used for determining significant environmental aspects. This information was then used next in identifying risk and opportunities, taking into account the context of the organization, interested parties, and significant aspects by adapting them into each of the scenarios below, reflecting possible approaches discussed during the 2013WG 5 meeting at Gaborone, Botswana (Greenwood 2013):

- Option 1: Single Path Approach: Risk Assessment Determines significant Aspects
- Option 2: Parallel Path Approach (A): One Process for Two Types of Aspects (environmental and "organizational")
- Option 3: Parallel Process Approach (B): Two Levels of Review: 1 SEAs, and 2. Business Risks & Opportunities
- Option 4: Parallel Process Approach (C): Two Levels of Review: Risks & Opportunities for Significant Environmental Aspects or Business Risks and Opportunities

Each scenario will be evaluated by the implementability using the existing procedures available in PGE Area Kamojang and the effect of the scenario to the identified significant aspects.

4. ANALYSIS AND DISCUSSION

4.1 Context of the Organization

The ISO 14001 revision Committee Draft (CD)2 requires that the organization determines its external and internal issues relevant to its purpose that affect its ability to achieve the intended outcomes of its EMS including environmental conditions capable of affecting or being affected by the organization (ISO/TC207 2013).

This case study is based on an organization with a mature, integrated management system. PGE Area Kamojang has been implementing ISO 14001 since 2002, ISO 9001 since 2006 and OHSAS 18001 since 2009. All systems are certified by a certifying body and have continually renewed its certification since each initial implementation.

The scope of PGE Area Kamojang's EMS is: Exploitation and Supply of Geothermal Steam for Electric Power Plant and Supply of Electricity to the Power Grid. PGE Area Kamojang operates the Kamojang Geothermal Field consisting of upstream activity (exploration and production of geothermal energy in the form of steam) since 1983, and since 2008 has also expanded their business by building and operating its own geothermal power plant.

The main consumer of the geothermal steam is a nearby power plant which buys steam from the company to generate 140 MW electricity, and the electrical utility company for buying the company's produced 60 MW of electricity which by law is the single buyer for all electricity produced by independent power producers in the country.

The geothermal field is located 1500 meters above sea level where water flowing from the nearby spring is collected in a dam and utilized for well injection and power plant utility water. Injection wells are used to inject condensate water from the power plant to recharge the reservoir and maintain reservoir pressure as an effort to produce the geothermal field in a sustainable way. Additional water from the dam is used occasionally and is limited by a permit.

The dam overflows downstream forming a creek and the water is utilized for various purposes such as paddy fields, households or industry.

The location of the power plant and main office is separated by a distance of 1000 meters, and between them is a village (mainly located closest to the main office) of which the inhabitants are mainly farmers, having their own farms or as workers in the surrounding farms producing seasonal vegetables (tomatoes, potatoes, cabbage, etc.) and some long-term crop such as coffee beans. Some contractors for PGE Area Kamojang also live in the village surrounding the area.

The total number of workers is approximately 450 people, one third being permanent workers while two thirds are contract workers. The workers mostly live in a nearby town, 25 km away from the geothermal field and use a company shuttle to go to work The power plant operators and security personnel work in shifts to operate and secure the power plant 24 hours a day, seven days a week.

The field has been among the top companies in Indonesia for environmental performance. It received the highest award (gold) from the Ministry of Environment for the last three years in their company's environmental rating program (PROPER). PROPER is one of the country's Ministry of Environment's efforts to encourage compliance of companies in environmental management through information instruments. Its goals are to create better environment, achieve sustainable development, create natural resources security and create conducive and environmentally friendly business climate which prioritize on application of clean production principles or eco-efficiency (Environment 2009).

Some issues that the company is currently facing taking into account the organization's context are listed in table 1.

Table 1: Identification of Issues Related to the Environmental Management System

Issues	Type (internal/external)	Relation to EMS
Global warming/climate change	External	An increase in ambient temperature would increase the frequency of forest fires
Resource depletion and biodiversity	External	May affect the ability to maintain gold PROPER award
Renewal of Unit I steam sales contract	External	Renewal clause most probably will adopt common practice of not pegging the steam price to oil anymore, causing significant reduction in revenues which affects budgets for EMS related actions/objectives.
Production well decrease	Internal	New wells needs to be drilled to uphold steam sales contract, causing potential environmental impacts

Interested parties to the organization are listed in table 2.

Table 2: Identification of Interested Parties and Their Expectations

Interested party	Type (internal/external)	Expectation
Customers	External	Steam and electricity supply complying to contractual agreement in terms of steam quality and supply continuity
Government: regency, province and national	External	Compliance with permits and regulations, increased revenue from taxes
Surrounding communities	External	Better community development programs and infrastructure improvements
Ministry of Environment	External	Complying with environmental regulations, improving cleaner production efforts.
NGOs	External	Contribution to their wellbeing and the community.
Contractors, suppliers, vendors	External	More jobs and projects that they can get involved in
Workers	Internal	Increase in welfare, job security, and industrial relations
Corporate	Internal	Maintain good reputation as a leader in environmental management (Gold PROPER)

4.2 Determination of Environmental Aspects

In implementing ISO 14001, the company has developed its own procedure to assess the environmental aspects. The aspects are ranked considering the likelihood and severity of each activity impact. The likelihood range from seldom to certain from level 1 to 5, and the severity lists environmental impact, effect on human, asset loss, reputation and operational disturbance from level 1 to 5. The risk is obtained by multiplying likelihood with severity which will result in a risk ranking range from 1 (minimum risk) to 25 (maximum risk).

The assessment also considers legal requirements, where each activity is assessed whether legal or other requirement has been met or not.

Below is the description of the assessment procedure taken from the company's documentation.

Table 3: Likelihood Criteria

Level	Likelihood	Description
1	Seldom	Has never happened / extra ordinary case / once in 10 years
2	Frequent	Happened in another place / once in 5 years
3	Very likely	Occasionally happens / once a year
4	Near Certain	Something that usually happens / every month
5	Certain	Something that always happens / every week

Table 4: Severity Criteria

Level	Description				
	Environmental Impact	**Effect on human**	**Asset Loss**	**Reputation**	**Operational disturbance**
1	Non-hazardous waste, no applicable regulation, recyclable, negligible potential of conserving natural resource (energy, water, etc.), improving biodiversity, or mitigating climate change.	First aid/medical treatment	Loss/repair cost < 5 million rupiah	Minor, internal report, no media coverage	No interruption in operation
2	Non-hazardous waste, meet environmental quality standards for waste, recyclable, very low potential of conserving natural resource (energy, water, etc.), improving biodiversity, or mitigating climate change	Serious injury/ Disability	Loss/ repair cost between 5 million to < 50 million rupiah	Local media coverage, loss reputation to customer, possibility of rule violation	Operational interruption 3 days or less
3	Non-hazardous waste, does not meet environmental quality standards for waste, not recyclable, low potential of conserving natural resource (energy, water, etc.), improving biodiversity, or mitigating climate change	Single Fatality	Loss/ repair cost between 50 million to < 500 million rupiah	Regional media coverage, most likely violation of rules	Operational interruption between 3 days to 1 month
4	Hazardous waste, recyclable, medium potential of conserving natural resource (energy, water, etc.), improving biodiversity, or mitigating climate change	Fatality of 2-10 people	Damage of main equipment, Loss/repair cost between 500 million to < 1 billion rupiah	National media coverage, violation of rules/ regulations	Operational interruption between 1 – 12 months
5	Hazardous waste, not recyclable, high potential of conserving natural resource (energy, water, etc.), improving biodiversity, or mitigating climate change	Fatality of more than 10 people	Damage to entire asset, Loss/ Repair cost > 1 billion rupiah	International media coverage, violation of regulations/law	Operational interruption for more than a year

To determine the severity level, the impact is assessed for each column, and the highest number level is chosen as the severity level for that impact. Once the likelihood and severity has been determined, the environmental impact rank is calculated using the formula:

Rank score = likelihood X severity

This process is done twice. The first rank scoring is done without considering existing controls in place for the initial impact assessment, and the second rank scoring is done with consideration of existing controls to obtain the residual impact rank score.

The process is accompanied by assessing the legal (regulatory) requirements and other requirements, if the regulatory and other requirements have been met then it will not affect the residual impact rank score to determine significant, but if the regulatory or other requirements have not been met, then this aspect will be significant despite of the residual impact rank score.

Identifying significant environmental aspects is done by following these criteria:

- Significant if the score of the environmental impact is higher than the average score of all environmental impact identified.
- Not Significant if the score of the environmental impact is lower than the average score of all environmental impact identified.

Significant environmental impact is followed up with an environmental management program based on priority. This priority is evaluated upon:

- Legal and other requirements.
- Budget availability.
- Availability of technology, applicability and implementability with time consideration to implement the program.
- Impact on operation and business.
- Needs and expectation of interested parties.

The Environmental Objective, Target, and Program are considered with regard to technological and financial ability and meet these criteria:

- In line with the environmental policy
- Specific (a clear starting point and final outcome to achieve).
- Measurable.
- Implementable and achievable.
- Has a clear timeline with regard to the significant environmental aspect and impact.

4.3 Scenario Analysis for ISO 14001 Risks and Opportunities

4.3.1 Option 1: Single Path Approach: Risk Assessment Determines Significant Aspects

All scenarios began by identifying the context of the organization, taking into account environmental conditions and issues (4.1), and needs and expectation of interested parties (4.2) according to the scope of the Environmental Management System (4.3). After this step the first option applied these criteria to assess risks and opportunities associated with environmental aspects by considering likelihood and severity of impacts, environmental conditions and issues and requirements of interested parties. The results of the risks and opportunities assessments are significant environmental aspects that can be addressed by the organization through actions such as setting an objective and environmental improvement program, operational control, emergency plan or other plans as appropriate.

The evaluation of the significant environmental aspects that needs to be addressed is listed in appendix A. The identified significant environmental aspects are potential inefficiency use of steam, water, electricity and office paper consumption. The environmental impact is natural resources depletion. These aspects are results of various activities: General consumption for operating the power plant, abnormal situations if the power plant trips, and power plant maintenance activity.

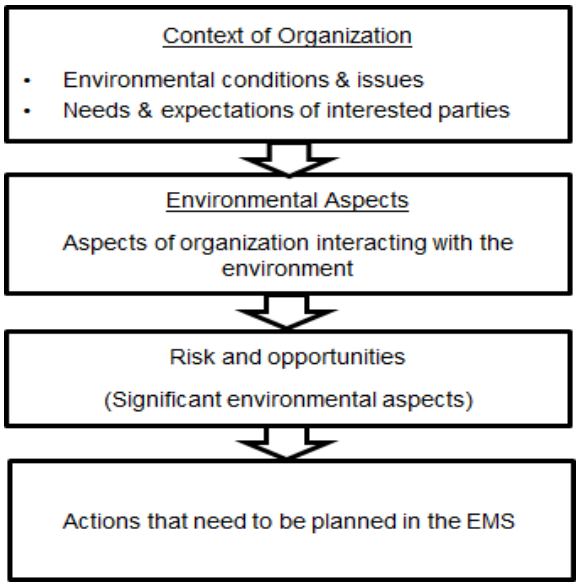

Figure 1: Diagram for Option 1. Single Path Approach: Risk Assessment Determines Significant Aspects

1) Implementability

The changes made to the existing process of identifying significant aspects by applying option 1 is easy to apply because it adds more criteria to the severity matrix of the risk and opportunity assessment process thus enriching the thought process by addressing the issues considered important to the organization and expectations of interested parties. The severity matrix could be modified to take into account these factors by adding other columns to add detail on each consideration, but in this exercise it was done by collecting all environmental considerations into one column.

2) Changes to Significant Environmental Aspects

The exercise was to apply context of the organization in the form of environmental conditions and issues and needs and expectations of interested parties into the criteria to determine significant environmental aspects. No changes in risk score were identified to the significant aspects using the new criteria. There are changes in the identified impact where there is more focus on global warming, but since the aspect has a low potential to have an effect on global warming the overall score doesn't change.

4.3.2 Option 2: Parallel Path Approach (A): One Process for Two Types of Aspects (environmental and "organizational")

After applying the same process of addressing the context of the organization, option 2 uses the criteria to assess "organizational" aspects (aspects of environment interacting with organization) and environmental aspects (aspects of organization interacting with environment). From both these processes, a list of significant organizational aspects and significant environmental aspects will be created. From the identified significant "organizational" aspects and environmental aspects the next process is to assess risks and opportunities that need to be addressed that are relevant to the EMS. These risks and opportunities are then followed up by the

organization through actions such as setting an objective and environmental improvement program, operational control, emergency plan or other plans as appropriate as in option 1.

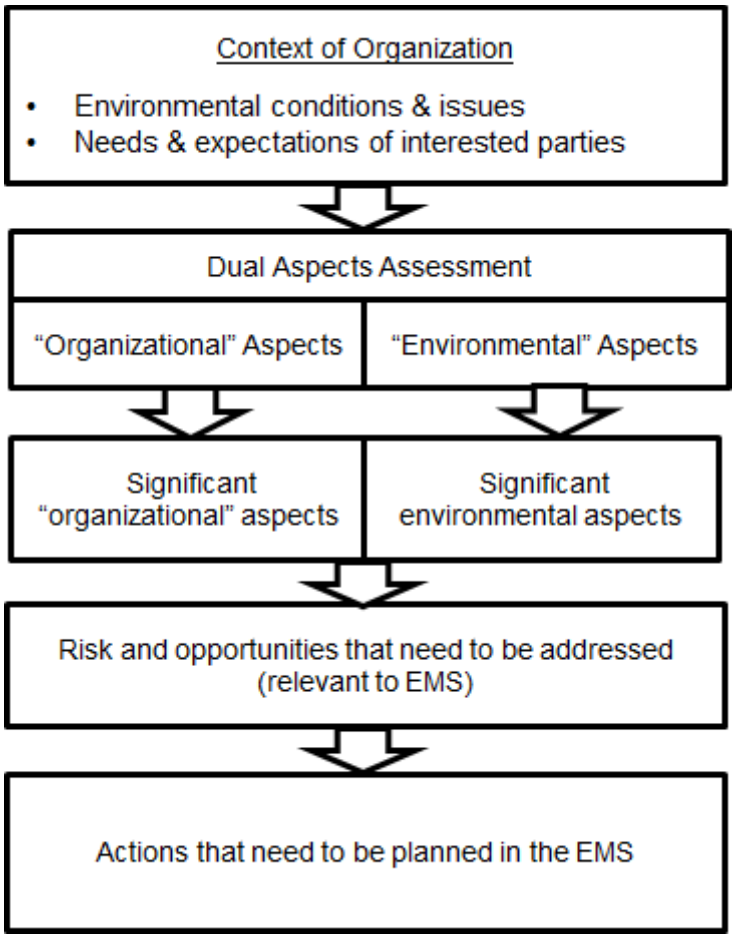

Figure 2: Diagram for Option 2. Parallel Path Approach (A): One Process for Two Types of Aspects (environmental and "organizational")

1) Implementability

The changes made to the existing process of identifying significant aspects by applying option 2 the way it is laid out is not an easy task. The problem with this option is the process of assessing significant environmental aspects comes before assessing risks and opportunities. The existing process uses risks assessment to come up with the significant environmental aspects. Therefore this option seems uneasy to implement with the existing mind set and needs further exploration on how to assess significant environmental aspects before taking into account risks and opportunities. It can be done but it would be redundant, doing the risk assessment process to determine significant aspects ("organizational" and environmental), then do the risk assessment process to determine risks and opportunities.

2) Changes to Significant Environmental Aspects

This option allows us to get more depth concerning the "organizational" aspects, where in option 1, this is addressed implicitly by taking into account environmental conditions and issues, along with needs and expectations of interested parties into the severity matrix of the risk assessment process. This option would allow us to assess these factors more thoroughly if the risks assessments could be done before the determination of significant aspects (both "organizational" and environmental).

4.3.3 Option 3: Parallel Process Approach (B): Two Levels of Review: 1 Significant Environmental Aspects, and 2. Business Risks & Opportunities

Option 3 utilizes information of business risks and opportunities identified through an enterprise risk management system/process. Depending on the organization this process may or may not exist. Business risks and opportunities relevant to EMS are then compiled with significant environmental aspects generated from the process similar to option 1 to determine actions that need to be planned by the organization in the EMS such as setting an objective and environmental improvement program, operational control, emergency plan or other plans as appropriate.

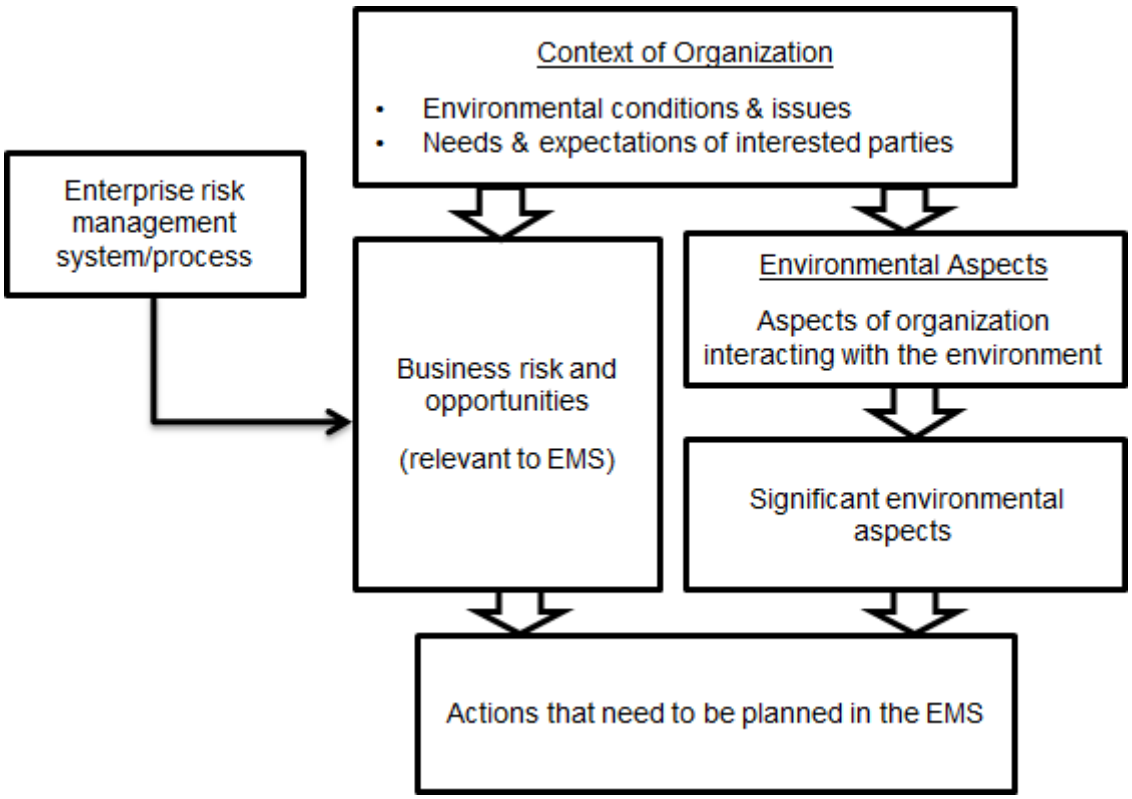

Figure 3: Diagram for Option 3. Parallel Process Approach (B): Two Levels of Review: 1 SEAs, and 2. Business Risks & Opportunities

1) Implementability

This option is easily implemented if the organization has an existing process of enterprise risk management. Business risks and opportunities identified from that process is then analyzed to evaluate the relevancy with EMS. In this exercise, a risk register obtained from the corporate risk management function can be was used to identify business risks and opportunities relevant to the EMS, which can add weight to some coinciding significant environmental aspects identified with the existing EMS process.

2) Changes to Significant Environmental Aspects

This option is likely to change the significant environmental aspects that were originally identified without considering business risks and opportunities identified through the enterprise risk management process. The difference in setting the risk criteria for defining risk level in the enterprise risk management and the existing EMS would be a factor in the difference. The enterprise risk management process also has a more global outlook and does not go into considerable detail as in the EMS process for each aspect. This process can be improved by aligning the risk criteria for both risk assessment process making it compatible with each other but with different perspective (global and detail).

4.3.5 Option 4: Parallel Process Approach (C): Two Levels of Review: Risks & Opportunities for Significant Environmental Aspects or Business Risks and Opportunities

This option in essence is similar to option 3, but somewhat redundant as in option 2 because there is a process to identify risks and opportunities after determining significant environmental aspects using the existing EMS process and assessing business risks and opportunities using the enterprise risk process. These risks and opportunities are then followed up with actions that can be addressed by the organization through actions as in all previous options.

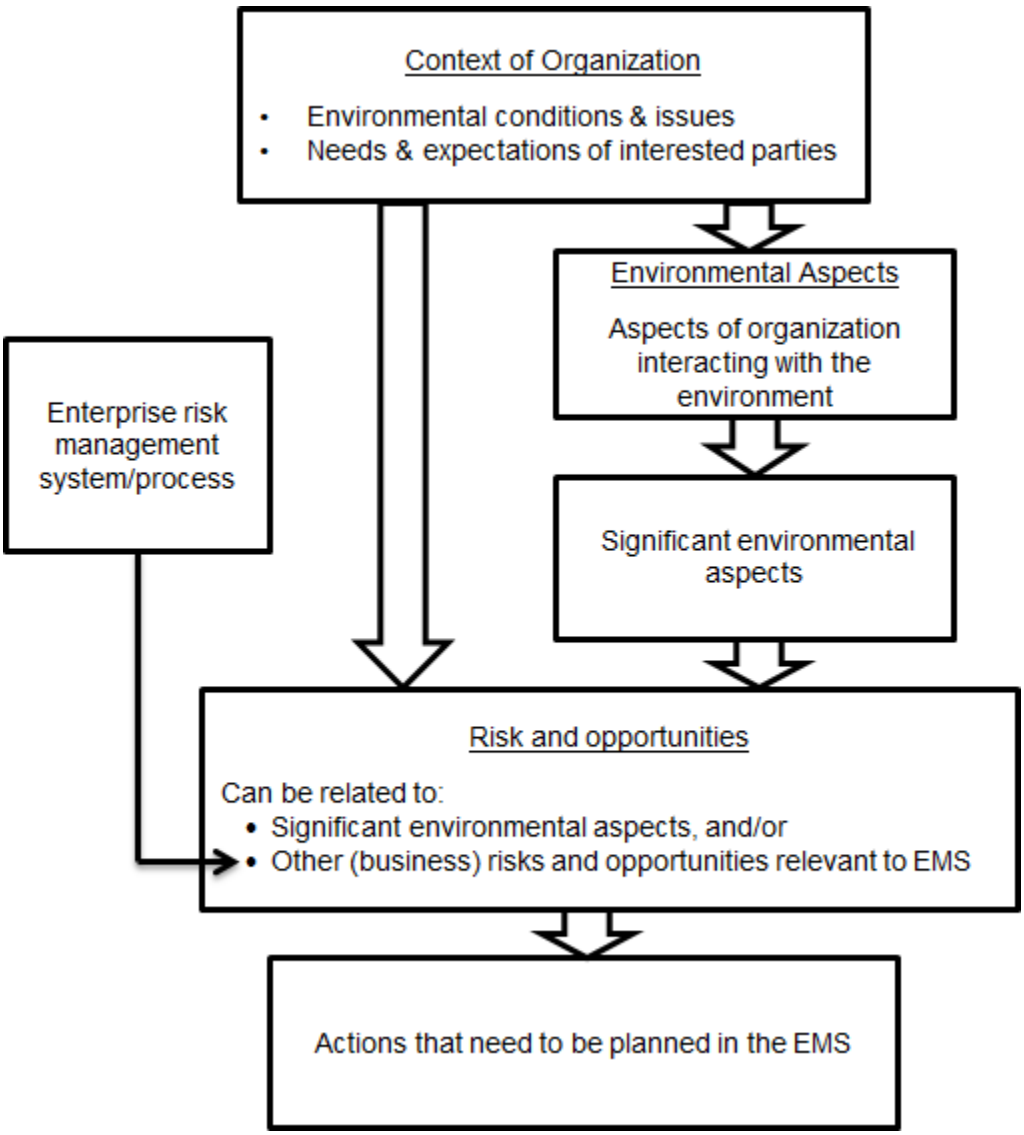

Figure 5: Diagram for Option 5. Parallel Process Approach (C): Two Levels of Review: Risks & Opportunities for Significant Environmental Aspects or Business Risks and Opportunities

1) Implementability

Similar to option 3, this option is easily implemented for an organization that has an existing enterprise risk management process. The difficulty in this option is the redundancy in the process where risks and opportunity are assessed three times: using the existing EMS, using enterprise risks management process and the combination of both. This could result in a more focused risks and opportunities in the end but does not appear practicable for implementing.

2) Changes to Significant Environmental Aspects

This option would have the same results as option 3, but through a longer and redundant process.

If we analyze the procedure it can be seen that the severity matrix (Table 4) has listed impact to the environment (column 1) and impact to the organization (column 2-5). This procedure is consistent with Option 1: Single Path Approach (A): Risk Assessment determines significant Aspects and Option 2: Parallel Path Approach (A): One Process for Two Types of Aspects (environmental and "organizational") approach in the exercise.

After simulating the 4 options, it is apparent that option 3 is similar to option 4, while option 1 and 3 has their unique characteristics. Options 2 and 4 has the same redundancy in the implementation of risks assessment where the process of assessing risks is redundantly repeated in identifying significant environmental aspects and repeated again in the risk and opportunities identification. Option 2 has an added value of explicitly assessing "organizational" aspects that could add some value to the end result, but other options has included this consideration in their criteria through the context evaluation (environmental conditions and issues, and interested parties needs and expectations).

PGE Area Kamojang could easily adopt the new revision of ISO 14001, either utilizing option 1 which is very similar with the existing process used by PGE Area Kamojang to determine significant environmental aspects using the risk matrix (likelihood and severity criteria) or option 3 since PGE has an enterprise risk management process that can be referred to in addressing the other

(business) risks and opportunities relevant to the EMS. This will allow a more depth evaluation of organizational risk but would require changes being made to the current severity criteria to separate environmental risk and organizational risk. The additional process needed is to identify the context of the organization, taking into account environmental conditions and issues and expectation of interested parties according to the scope of the EMS which is required for all options.

5. CONCLUDING REMARKS

This application has shown how different options of implementing the proposed ISO 14001 would benefit the organization by considering the context of the organization through looking at environmental conditions and issues, and the needs and expectations of interested parties. The organization will then use this information along with legal and other requirements in setting up criteria to identify their significant environmental aspects and actions needed to place in their EMS to address these aspects.

Through simulating the 4 options, the easiest option to implement is option 1. Option 1 is very similar to the significant aspect identification of the existing ISO 14001 implementation with modification in the criteria to determine severity by adding to the matrix some points to address the environmental conditions and issues and needs and expectations of interested parties. This option does not change much of the outcome of significant aspects identified using the existing ISO 14001 process.

The second easiest option to implement is option 3, where organizations having an existing enterprise risk management system would be able to utilize the risk register from that process to identify business risks and opportunities that are relevant to the EMS and consider it into the decision process of actions that need to be planned in the EMS along with the significant environmental aspects identified using the existing EMS process. This option has an added value of linking business risks and opportunities with ISO 14001 and in the writer's opinion would add more value than option 1.

The identified significant environmental aspect in this case study did not change using option 1 and the sample process used (power plant operation). Implementing the option(s) to the entire organization would probably result in changes of significant environmental aspects since other department's activities have different degrees of correlation to the context, environmental conditions and issues and expectation of interested parties.

Further research could be done by including the entire organizations process from all departments and simulating all options possible by modifying the existing process to determine significant environmental aspects.

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APPENDIX A. ENVIRONMENTAL ASPECT IDENTIFICATION

NUMBER OF ASPECTS	ASPECT CODE	Normal / Abnormal	ACTIVITIES AND PRODUCT (A)		ENVIRONMENTAL ASPECTS (B)		(C)	IMPACT EVALUATION: Initial Impact Evaluation				Control	Residual Impact			(P)
			DESCRIPTION	CAPACITY	DESCRIPTION	QUANTITY	ENVIRONMENTAL IMPACT	Sev	Like	Rank	Legal	Existing Control In Place	Sev	Like	Rank	P= Significat, if rank >= Total/N or legal=N, TP = Not Significant if rank < Total/n
N	(1)		(1)	(2)	(1)	(2)										
1. POWER PLANT OPERATION																
1	PLTP-LL-1	normal	Utilization of steam, water, and electricity for power plant operation and own use.		- Potential inefficiency of resource usage (steam, water, electricity)		- Natural resources depletion	2	5	10	Y	SOP, Power Monitoring, Totaliser	2	4	8	P
3	PLTP-LL-2	normal	Steam supply	430 Ton/hour	- Discharge of H2S gas in the steam		- Air pollution	2	5	10	Y	SOP	2	2	4	TP
	PLTP-LL-3	normal			- Heat discharge		- Health problems	1	5	5	Y	SOP	1	2	2	TP
	PLTP-LL-4	normal			- Noise		- Nuisance	2	5	10	Y	SOP	2	2	4	TP
5	PLTP-LL-5	normal	Turbine Generator Operation	10 barg, 186 degC, 3000RPM, 80MVA	- Heat discharge		- Health problems	1	5	5	Y	SOP	1	3	3	TP
	PLTP-LL-6	normal			- Potential inefficiency of resource usage (steam, water, electricity) due to unit trip	430 Ton/hour	- Natural resources depletion	1	5	5	Y	SOP, Re-engineering	1	3	3	TP
	PLTP-LL-7	normal			- Potential waste of paper for checksheet and power plant performance calculation.		- Natural resources depletion	2	5	10	Y	SOP	2	3	6	TP
	PLTP-LL-8	normal			- Miss-operation that could cause unit Trip (Potential inefficiency of usage)	430 Ton/hour	- Natural resources depletion	1	5	5	Y	SOP, Re-engineering	1	4	4	TP
	PLTP-LL-9	normal			- Noise	95 dB	- Nuisance	2	5	10	Y	SOP	2	3	6	TP
2	PLTP-LL-10	normal	Hot Well Pump op	590 RPM	- Noise	95 dB	- Nuisance	2	5	10	Y	SOP	2	3	6	TP
	PLTP-LL-11	normal			- Potential inefficiency of resource usage (steam, water, electricity) due to unit trip	430 Ton/hour	- Natural resources depletion	1	5	5	Y	SOP, Re-engineering	1	3	3	TP
2	PLTP-LL-12	normal	Cooling tower ope	7500 Ton/hour	- Discharge of H2S, CO2 gas in the steam	1%	- Health problems	2	5	10	Y	SOP	2	3	6	TP
	PLTP-LL-13	normal			- Potential excessive use of water from manual cleaning of filter		Water waste	1	5	5	Y	SOP	1	4	4	TP
1	PLTP-LL-14	normal	Air Receiver Tank operation for moving control valve		- Delay in control valve operation which can cause unit Trip and Potential inefficiency of steam,water and electricity usage		Natural resources depletion	1	5	5	Y	SOP	1	4	4	TP
1	PLTP-LL-15	normal	Gas extraction operation		- Noise	95 dB	- Nuisance	3	5	15	Y	SOP, Re-engineering	2	3	6	TP
1	PLTP-LL-16	normal	Trafo operation	6-80 MVA	- Trafo oil spill		- Soil contamination	4	5	20	Y	SOP, Absorbent Recycle	4	1	4	TP
1	PLTP-LL-17	normal	Waste water drainage to Cikaro river		- Soil contamination		- Soil contamination	3	5	15	Y	SOP, Re-engineering	2	3	6	TP
3	PLTP-LL-18	abnormal	Blackout, gnd failure while emergency power not functioning causing uncontrollable operation, over pressure pipelines	electricity 63 MW, steam 430 Ton/hour	- Gas discharge in the steam		- Air pollution	2	1	2	Y	SOP	2	1	2	TP
	PLTP-LL-19	abnormal			- Heat discharge		- Health problems	2	1	2	Y	SOP	1	1	1	TP
	PLTP-LL-20	abnormal			- Noise		- Nuisance	2	1	2	Y	SOP	2	1	2	TP
2	PLTP-LL-21	abnormal	Diesel Engine Operation (DEG), Fire Pump, Diesel Water Transfer Pump, Portable		- Fuel spill		- Soil contamination	4	5	20	Y	SOP	4	1	4	TP
	PLTP-LL-22				- CO2 emission		- Air pollution	2	5	10	Y	SOP	2	3	6	TP
2. CHEMICAL DOSING																
1	PLTP-LL-23	normal	Use of chemicals: Biocide, Caustic Soda, bisulphite		- Over acidic/base condensate		- Water pollution	2	5	10	Y	SOP	2	3	6	TP
1	PLTP-LL-24	normal	Transport and filling of Biocide, Caustic Soda, bisulphite		- Chemical spill		- Soil contamination	4	5	20	Y	SOP, NaOH refill	4	3	12	P
3. FUEL SUPPLY																
1	PLTP-LL-25	normal	Loading Unloading of fuel		- Fuel spill		- Soil contamination	4	3	12	Y	SOP, Modification	4	3	12	P
4. MAINTENANCE																
7	PLTP-LL-26	normal	Preventive Maintenance, Predictive Maintenance & Corrective Maintenance	Daily	- Oil spill		- Soil contamination	4	5	20	Y	SOP, Absorbent recycle	4	3	12	P
	PLTP-LL-27	normal			- Oil spill		- Water pollution	4	5	20	Y	SOP, Absorbent recycle	4	3	12	P
	PLTP-LL-28	normal			- Waste oil		- Soil contamination	4	5	20	Y	SOP, Absorbent recycle	4	3	12	P
	PLTP-LL-29	normal			- Waste oil		- Water pollution	4	5	20	Y	SOP, Absorbent recycle	4	3	12	P
	PLTP-LL-30	normal			- Contaminated Solid waste		- Soil contamination	4	5	20	Y	SOP, Absorbent recycle	4	3	12	P
	PLTP-LL-31	normal			- Contaminated Solid waste		- Water pollution	4	5	20	Y	SOP	4	3	12	P
	PLTP-LL-32	normal			- Scrap waste		- Soil contamination	2	5	10	Y	SOP	2	3	6	TP
3	PLTP-LL-33	abnormal	Non routine maintenance (Overhaul/Turn Around, Outage, Modifikasi)		- Oil spill		- Water pollution	4	3	12	Y	SOP, JSA, QCP, Absorbent Recycle	4	3	12	P
	PLTP-LL-34	abnormal			- Potential-uncontrolled disposal of liquid/solid waste		- Soil contamination	1	3	3	Y	OP, JSA, Absorbent recyc	1	1	1	TP
	PLTP-LL-35	abnormal			- Chemical spray waste		- Air pollution	4	5	20	Y	SOP, JSA, QCP	4	1	4	TP
5. LABORATORIUM																
2	PLTP-LL-36	normal	Sampling and analysis produces (used sample oil, used flushing oil		- Potential-uncontrolled disposal of liquid/solid waste		- Water pollution	4	5	20	Y	SOP, Temporary waste containment	4	3	12	P
	PLTP-LL-37	normal					Soil contamination	4	5	20	Y	SOP, Temporary waste containment	4	3	12	P
2	PLTP-LL-38	normal	Reagent storage		- Potential-uncontrolled disposal of liquid/solid waste		- Water pollution	4	3	12	Y	SOP	4	3	12	P
	PLTP-LL-39	normal					Soil contamination	4	5	20	Y	SOP, Temporary waste containment	4	3	12	P
2	PLTP-LL-40	normal	Reagent preparation		- Expired reagent		- Water pollution	4	5	20	Y	SOP, Temporary waste containment	4	3	12	P
	PLTP-LL-41	normal					Soil contamination	4	5	20	Y	SOP, Temporary waste containment	4	3	12	P
6. OTHER ACTIVITIES																
1	PLTP-LL-42	normal	Printer usage for paperwork	1/bulan	- Toner waste		- Soil contamination	4	4	16	Y	Safety briefing	4	3	12	P
1	PLTP-LL-43	normal	Toilet		- Waste water		- Water pollution	1	4	4	Y	Safety briefing	1	3	3	TP
1	PLTP-LL-44	normal	Pantries		- Waste water		- Water pollution	1	4	4	Y	Safety briefing	1	3	3	TP